HEALTHY FOOD CHOICE: HOW ENVIRONMENT AND COGNITION DETERMINE WHAT WE EAT

D i s s e r t a t i o n

zur Erlangung des akademischen Grades Dr. rer. nat.

im Fach Psychologie

eingereicht an der

Mathematisch-Naturwissenschaftlichen Fakultät II

der Humboldt-Universität zu Berlin

von

Dipl.-Psych. Jutta Mata,

geboren am 30. August 1978 in Berlin

Präsident der Humboldt-Universität zu Berlin

Prof. Dr. Christoph Markschies

Dekan der Mathematisch-Naturwissenschaftlichen Fakultät II

Prof. Dr. Wolfgang Coy

1. Gutachten: Prof. Dr. Gerd Gigerenzer, Humboldt Universität & MPI Bildungsforschung

2. Gutachten: Prof. Dr. Elke van der Meer, Humboldt Universität

3. Gutachten: Prof. Dr. Peter Todd, Indiana University Bloomington

Tag der Verteidigung: 21. Januar 2008

Acknowledgments

First and foremost I want to thank my advisors, Peter Todd, and Sonia Lippke for their precious help, challenging questions and advice throughout the three years of this dissertation. Peter was an excellent, trusted, and very supportive mentor; his fascination for science and strange foods is contagious and made this dissertation an exciting endeavour. Sonia always made me think about the health psychology perspective on my research. She was an outstanding, extremely reliable and helpful advisor who at all times anticipated possible obstacles and offered solutions as well as chocolate.

This work was conducted at the Center for Adaptive Behavior and Cognition at the Max Planck Institute for Human Development. I am truly thankful to Gerd Gigerenzer for inviting me to work in this very stimulating, interdisciplinary, and friendly working environment. I am also grateful for the opportunity of being part of the International Max Planck Research School LIFE and want to thank the directors of the LIFE research school Paul Baltes, Jacque Eccles, Ulman Lindenberger, and John Nesselroade for providing with many opportunities for additional training, feedback and discussions. I met fantastic people through LIFE, including Andreas Wilke, Jessica Garrett, Bettina von Helversen, Poldi Kuhl, Christina Röcke, and Christina Limbird with whom I spent innumerous days and nights at the office, the LIFE academies, and working in cafés, and who have been wonderful friends, housemates and travel companions. I especially want to thank Jacque for supporting my stay at her lab at the University of Michigan, her very warm welcome there and for her discussions and feedback that made my stay there a very productive one.

I am also indebted to Peter Todd for inviting me to work with him at the Indiana University in Bloomington, for showing me Bloomington campus life as well as connecting me with researchers worldwide. I also want to thank Peter and Anita Todd (and Imogen and Graham) for their generous hospitality during my numerous stays in Bloomington – I couldn't have asked for more.

I am grateful to Ralph Hertwig for inviting me to work at his lab at the University of Basel, and to Steffi Kurzenhäuser and Thorsten Pachur for their helpful insights and generous hospitality.

I would like to thank my dissertation committee for their unbureaucratic ways; Gerd Gigerenzer, Elke van der Meer, and Peter Todd for writing a review of my thesis and Jens Asendorpf for agreeing to be head of the committee.

A big Thank You to my colleagues at the Center for Adaptive Behavior and Cognition, especially Bettina von Helversen who discussed a trillion big and small (research) questions with me from her side of the office desk, and Benjamin Scheibehenne who was a

splendid office mate in Bloomington and Berlin and a lot of fun to work with on the children's preference prediction study. I also want to thank Monika for great advice and her kind support, Uwe Czienskowski for programming, and Gregor Caregnato, for running the experiments of the meat label study, as well as Christian Elsner who provided reliable technical support and sweets over the last years. I want to thank the members of the "ABC-food group", Julia Schooler, Anja Dieckmann, and Lael Schooler, for their helpful feedback. Furthermore, I am grateful to all friends and colleagues who gave me feedback on previous versions of elements of this dissertation, namely, Edward Cokely, Wolfgang Gaissmaier, Mirta Galesic, Poldi Kuhl, Julian Marewski, Susanne Ramge, and Andreas Wilke – and especially to Anita Todd who critically and carefully edited every part of this dissertation. Furthermore I am indebted for the precious help I received from my student assistants, Sylvia Böhme, Linda Miesler, Vera Schneider and David Wisniewski, and my interns, Markus Wettstein, Berit Hoerner, Lisa Warner, and Franziska Hoffmann.

I also want to thank my family and friends, especially Sue, Anna, Andreas, Jessica, Katrin, and Marscha who never lost trust in my abilities and comforted me during times of frustration. Finally, I want to thank Rui for his never ending encouragement, countless discussions, proofreading, advice on programming, coming up with the dissertation title, and most importantly, making life brighter beyond words.

Deutsche Zusammenfassung

Die vorliegende Dissertation setzt sich mit Entscheidungen im Ernährungsbereich auseinander. Sie beschäftigt sich insbesondere damit, wie das Zusammenspiel von Umwelt und Kognition diese Entscheidungen beeinflusst. Im ersten Manuskript, “When Diets Last: Lower Cognitive Complexity Increases Diet Adherence” wird die Bedeutung der kognitiven Komplexität von Ernährungsregeln für das Einhalten einer Diät untersucht. Diesem Projekt liegt die Annahme zugrunde, dass Diäten scheitern können, weil sie aus kognitiver Perspektive zu komplex sind. Zum Beispiel können sich Diäthaltende nicht alle wichtigen Informationen merken oder verarbeiten. Der Einfluss von kognitiver Komplexität wurden aus zwei Blickwinkeln betrachtet: Zum einen aus der Umweltperspektive, in dem Essensregeln aus beliebten Diätbüchern bezüglich ihrer Komplexität analysiert wurden, zum anderen aus der subjektiven Perspektive von 1136 Diäthaltenden einer längsschnittlichen Onlinestudie. Neben der wahrgenommenen Regelschwierigkeit verschiedener Diäten wurden weitere Faktoren, die in früheren Studien das Durchhalten von Diäten beeinflusst haben, erhoben. Vorangegangenes Diätverhalten, Selbstwirksamkeit, Planung und wahrgenommene Regelschwierigkeit erhöhten das Risiko, die Diät vorzeitig aufzugeben, wobei Selbstwirksamkeit und wahrgenommene Regelschwierigkeit die einflussreichsten Faktoren waren. Im zweiten Manuskript „Meat Label Design: Effects on Stage Progression, Risk Perception, and Product Evaluation” werden zwei Studien vorgestellt, die den Einfluss gesundheitsrelevanter Informationen auf Labeln für Produktbewertung, Risikowahrnehmung und der Intention, Tierhaltung und Inhaltsstoffe von Lebensmitteln in die Kaufentscheidung einzubeziehen, untersuchen. Es wurde betrachtet, wie Inhalt und Kontext (separate versus conjoint Darbietung) der Labelinformation die Bewertung von Fleischprodukten beeinflusst. Die Ergebnisse zeigen, dass sich bei einer conjoint im Gegensatz zur separaten Darbietung die Bewertung der Produkte umkehrt. Darüber hinaus hatten solche Personen, die zuvor nicht motiviert waren gesundheitsrelevante Aspekte in ihr Einkaufsverhalten einzubeziehen, nach Betrachten der Label eine höhere Intention diese zu berücksichtigen. Im dritten Manuskript, „Predicting Children’s Meal Preferences: How Much Do Parents Know?“, wurden Präferenzvorhersagen bezüglich der Essensentscheidungen Anderer erforscht. Es wurde untersucht, wie gut und mit Hilfe welcher Information Eltern die Mittagessenpräferenzen ihrer Kinder vorhersagen. Die Vorhersagegenauigkeit der Eltern entsprach der Stabilität der Essenspräferenzen ihrer Kinder, d.h. dass die Eltern so genau waren, wie möglich. Die Ergebnisse suggerieren, dass Eltern vor allem spezifisches Wissen über die Präferenzen ihrer Kinder und Projektion ihrer eigenen Vorlieben für die Vorhersagen nutzten.

English Summary

This dissertation focuses on food-related decision making, in particular, how environment and cognition interact to determine people's food choices. The first manuscript, "When Diets Last: Lower Cognitive Complexity Increases Diet Adherence," investigates the role of the cognitive complexity in diet adherence. The underlying assumption guiding this research is that many popular weight loss diets fail because they are too complicated from a cognitive point of view, meaning that dieters are not able to recall or process the diet rules. The impact of excessive cognitive demands on diet adherence and dieters' perception of diet rule complexity were investigated from an environmental perspective, by analyzing diet rules in books, and from the cognitive perspective of 1,136 dieters in a longitudinal online-questionnaire. We measured perceived rule complexity across different weight-loss diets controlling for other factors known to influence adherence. Previous diet behavior, self-efficacy, planning and perceived rule complexity predicted an increased risk to quit the diet prematurely, with self-efficacy and diet complexity being the strongest factors.

The second manuscript, "Meat Label Design: Effects on Stage Progression, Risk Perception, and Product Evaluation," presents two studies which tested the impact of health-related meat labels on product evaluation and risk perception. Specifically, the studies examined how informational content and the context (separate vs. conjoint evaluation) in which labels are assessed influence the evaluation of meat products. The results showed that conjoint assessment of labels can lead to contrary product rankings compared to separate evaluations. Moreover, the results suggest that being exposed to food labels containing specific health-relevant information can lead to increased risk perception and motivation to consider health aspects in those consumers without previous intention to do so.

The third manuscript, "Predicting Children's Meal Preferences: How Much Do Parents Know?" investigated prediction behavior concerning other people's food choices. In particular, it asked how accurately and what cues parents use to predict their children's meal choices. Overall, parents' prediction accuracy matched the stability of children's meal choices, implying that accuracy was as high as can be expected. The results suggest parents were able to obtain high predictive accuracy by using specific knowledge about their child's likes and projecting their own preferences.

Table of Contents

General Introduction

You are what you eat—and across the Western world, people eat too much: Almost every third U.S. American is classified as obese (e.g., Baskin, Ard, Franklin, & Allison, 2005; Hill, Wyatt, Reed, & Peters, 2003); in at least half of the European Union member states prevalence levels of obesity in the population are higher than 20% (Fry & Finley, 2005); in Germany, this rate is around 23% (Prugger & Keil, 2007). Still, the numbers are rising (e.g., Ezatti, Martin, Skjold, Van der Hoorn, & Murray, 2006; Flegal, Carroll, Ogden, & Johnson, 2002; Foreyt & Goodrick, 1995; Taubes, 1998; Utz, 2004; World Health Organization, 1998), and other regions are witnessing similar trends: In China, for example, the obesity prevalence between 1989 and 1997 more than tripled from 0.3% to 1.0% (Bell, Ge, & Popkin, 2001).

This increase is alarming because overweight and obesity are risk factors for a number of serious and chronic health problems (National Heart, Lung, and Blood Institute Obesity Education Initiative Task Force Members, 1998). Poor diet is one of the three most prevalent causes of death in the United States (McGinnis & Foege, 1993; Mokdad, Marks, Stroup, & Gerberding, 2004). Overweight and obesity is associated with many diseases such as type 2 diabetes and metabolic syndrome, as well as coronary heart disease, certain forms of cancer, sleep-breathing disorders, and osteoarthritis (Kopelman, 2000). Overweight and obesity are turning into a costly health problem in the Western world (e.g., Brownell & Wadden, 1992); the estimated costs of obesity amount to around 7% of total health costs (Kortt, Langley, & Cox, 1998; Seidell, 1996).

Overweight and obesity are correlated with poor eating habits, that is, consuming excessive amounts of foods and/or foods high in calories but low in nutrition (Booth, 1994). Thus, changing eating behavior, such as consuming fewer calories or choosing foods lower in fat or higher in fiber, can prevent weight gain or help an individual reach a healthy body weight (for a review see Powell, Calvin, & Calvin, 2007). Weight loss with the goal of

reaching a healthy body weight has been associated with significant health benefits, such as reduced risk of cardiovascular disease and type 2 diabetes (e.g., Pasanisi, Contaldo, de Simone, & Mancini, 2001; Vidal, 2002). Many overweight people attempt to regulate their weight but the large majority fails to lose a significant amount of weight or to keep it off (Jeffery et al., 2000). This can lead to the so-called weight cycling, also known as yo-yo effect, which some studies have been found to have a worse effect on general health than moderate overweight (Brownell & Rodin, 1994). However, other scientists have shown that weight loss is more important than the way to get there, not finding negative effects of weight cycling (Prentice et al., 1992; Wing, Jeffery, & Hellstedt, 1995). Therefore, researching how overweight can be prevented, and how people can successfully lose excessive weight and maintain weight loss remains a crucial necessity.

Thus far, most psychological research studying overweight prevention has focused on the individual as the problem, concluding that people can make better nutritional choices if they know more, are motivated, and focus more on volitional aspects of behavior change (e.g., Schwarzer et al., 2007; for a review on theories of health-protective behavior see, e.g., Conner, & Armitage, 2002; Weinstein, 1993). However, research in other domains suggests that using the structure of the environment might offer a better explanation of why these behaviors occur and how they could be changed. One example is given by Johnson and Goldstein's (2003) study of organ donation: They reported that despite an 85% approval rate for organ donation in the United States, only 28% of the population had signed a donor card, a gap between intention and behavior that has also been found in other countries with a so-called opt-in policy, where people have to be active in order to become organ donors. Whereas in the countries that have an opt-out default, Johnson and Goldstein found consent rates for organ donation of between 86 and 99%.

This example illustrates the potential power of the environment structure to influence behavior and suggests possible departures for interventions. The goal of this dissertation is to

contribute to the understanding of this often-neglected impact of environmental factors on food-related decision making. Environment and its influence on eating behavior have been studied in the context of marketing (for a review see Wansink, 2004), where research has focused primarily on product environments such as package sizes or shapes of drinking glasses, as well as in public health (for a review see French, Story, & Jeffery, 2001), where the concentration has been on the population level, for example, associating increases in the number of fast food restaurants with weight gain in the population. However, environmental aspects have received little attention in psychological research on eating behavior, with the exception of some aspects of the social environment (e.g., parent feeding style, presence of others; for reviews see Birch, 1999; Herman, Roth, & Polivy, 2003).

Herbert Simon (1956) pointed out the importance of environment structure for choice. Using a simple example of a rat searching for food, he identified structural characteristics and suggested that an organism could satisfy its needs in such an environment with very simple perceptual and choice mechanisms, by relying on a few important clues only. This approach to decision making was taken up and developed further by Gigerenzer and colleagues (Gigerenzer, Todd, & the ABC Research Group, 1999). They identified simple heuristics that people follow to make inferences, for example, about which of two cities is bigger, based on environmental cues such as the existence of an airport, university, or soccer team, showing that for predicting people's decisions, these simple algorithms were as good as or better than more complex models requiring a huge amount of computation, unlikely to be performed by humans (e.g., Goldstein & Gigerenzer, 2002).

Studying environmental influences on eating behavior is difficult, because environments are difficult to define, measure, and study experimentally (French et al., 2001). In this dissertation, I report on six empirical, theory-driven studies that were conducted across three areas of food-related decision making, measuring and testing the influence of different environmental factors on food choice—including the effect of cognitively complex food

choice and eating rules on adherence to a dietary program; effect of food label design on food-related perceptions; and prediction of meal preferences.

In the remainder of this Introduction I describe why investigating food choice and eating behavior contributes to a better understanding of overweight and obesity. I summarize factors that influence both food choice and intake, including evolutionary, cultural, sensory and taste features, and motivational aspects, as well as characteristics of the physical and social environment. Then, previous research on decision making in the food domain will be discussed. Last, I give an outline of the dissertation chapters.

Factors Influencing Food Choice and Eating Behavior

Evolution, Culture, and Taste

What determines food choice, and why do people make poor food choices and/or eat excessive amounts, leading to overweight and obesity? Evolution might have something to do with it, because humans have a genetic predisposition to like sweet and salty tastes (Birch, 1999; Desor, Greene, & Maller, 1975; Rozin, 2000) and love high-fat food (Birch, 1992; Mela, 1992). In ancestral environments, liking these foods might have been advantageous because a taste for sweet, salty, or fatty would have been a proximal mechanism promoting ingestion of foods that were good sources of necessary nutrients (Birch, 1999). Although we live in a different food environment now, we are still prone to eat those foods that are often high in calories, and we continue not to be initially attracted by vegetables, which are typically neither sweet, salty, nor high in fat (Birch, 1999).

Recent reviews on genetic influences on individual food choice suggest that genetic differences explain relatively little variance; instead, environment effects are important (cf., Birch, 1999). Birch argued that food preferences are learned through experience with food and eating. These preferences, which—according to reports by consumers—strongly guide our food selections (Food Marketing Institute, 1996), underline the importance of pleasure

that humans get from eating. Children, especially, eat more of the foods they like best (Birch, 1992). The link between taste preferences and food consumption in adults is less apparent; for example, adults who especially like salty foods do not consume more sodium (Drewnowski, Henderson, Driscoll, & Rolls, 1996). However, people who prefer sweet foods also report a higher consumption of foods that are sweet (Roininen, et al., 2001). In his review on taste preferences and food intake, Drewnowski (1997) concluded that sensory responses to taste, smell, and texture of foods are associated with food preferences and eating habits. However, they alone do not predict food consumption; other factors such as sex, age, attitudes, as well as social and economic variables should be considered in addition.

A powerful factor in food choice and eating behavior is culture (de Garine, 1972; Rozin, 2000). Rozin described how culture (apart from human nutritional needs) has shaped our cuisine, and also human nutritional needs. A prominent example is milk, which for precultural human adults was indigestible. It became readily available as a food with the domestication of animals. There were two solutions to the problem of how to make milk digestible: The cultural one was to digest milk outside the body by processing it into products such as yogurt or cheese; the biological solution was to select for humans who still produced lactose as adults and thus tolerated milk, which happened most frequently in dairying populations (Rozin, 2000).

Rozin suggested that the link between culture and food is so strong that if one has only a single question to find out which culture a person belongs to, one should ask about her eating habits (Rozin & Vollmecke, 1986). Culture is also closely linked to geographic region (with the exception of immigrants, who often stay loyal to their eating habits in their new country; Rozin, 1996). For example, use of spices is associated not only with availability in a certain region but also with its function of inhibiting bacteria growth in food: The warmer the country, the more different spices are used, including a large number that inhibit bacteria growth (Sherman & Billing, 1999). Culture is also important for food intake—for example, on

Nauru being heavy is considered attractive. In ancient times it ensured survival of the rough life on the island; thus Nauru Islanders used to put their girls on a diet to make them fat (Diamond, 2003).

Knowledge and Motivational Influences

Psychologists have attempted to address the explosion in obesity rates by increasing peoples' motivation to change their nutrition behavior. Intention formation can be aided by educating people about the characteristics of food, including how food can put their health at risk or addressing ethical arguments, such as mode of production (e.g., animal welfare; fair trade of coffee or chocolate). Information is assumed to be the basis for risk perceptions and outcome expectancies, and thus eventually behavior.

In the case of food, one way to disseminate relevant information is on food labels. These can educate consumers about diet and health (Caswell & Padberg, 1992; Higginson, Rayner, Draper, & Kirk, 2002, Leathwood, Richardson, Straeter, Todd, & van Trijp, in press), explicitly convey information about a product at the point of purchase (Bettman, Payne, & Staelin, 1987), and affect whether a product is purchased (Anderson et al., 1997; Bjørner, Hansen, & Russell, 2004; Levy, Mathews, Stephenson, Tenney, & Schucker, 1985). Other means of education include brochures, advertisements, newspaper articles, reports on radio or TV, or lessons in school. Most models of health behavior change aim to describe and predict behavior change, including nutrition behavior. Such models are based on the idea that knowledge can influence intention to perform a behavior, for example, knowledge about risks is considered in the form of perceived vulnerability and severity of behavior consequences in the Health Belief Model (Becker, 1974), the Protection Motivation Theory (Rogers, 1975), and the Health Action Process Approach (Schwarzer, 1992). Knowledge is assumed to be the basis for attitudes in the Theory of Planned Behavior (Ajzen, 1985); and is implied in the constructs of consciousness raising as well as pros and cons in the Transtheoretical Model of

Health Behavior Change (Prochaska & di Clemente, 1983). Knowledge, however, is not the only determinant of behavior; in fact, there has yet to be found one, singularly important factor—a "magic bullet"—that explains health behavior (Oxman, Thomson, Davis, & Haynes, 1995). It seems that knowledge, for example, in the form of risk perception, is especially important for the formation of an intention to change behavior (e.g., Schwarzer et al., 2007). Another prominent factor thought to affect health behavior is self-efficacy (Bandura, 1977), that is, the extent to which a person believes he or she can behave in a certain way (e.g., stick to a weight loss diet), similar to the concept of perceived behavioral control (Ajzen, 1985). Risk perception, self-efficacy, and outcome expectancies are assumed to lead to the formation of intention for changing a behavior (e.g., Schwarzer, et al., 2007). Many models presume that intention is a direct predictor of behavior (e.g., Theory of Planned Behavior; Ajzen, 1985) and largely ignore volitional factors mediating between intention and behavior. However, volition, that is the act of making a conscious choice (e.g., making specific plans on how to carry out a behavior; Leventhal, Singer, & Jones, 1965), also referred to as implementation intentions (Gollwitzer, 1999), was found as imperative factor for behavior change (Gollwitzer & Sheeran, 2006).

Despite considerable success of models of health behavior change in explaining and predicting nutrition behavior change (e.g., Armitage & Conner, 1999; Schwarzer & Renner, 2000; Schwarzer et al., 2007), these models still attribute the responsibility of food choice and eating patterns solely to the individual who struggles (and often fails) to keep up healthy eating habits in our modern world, which has been called an obesogenic environment (e.g., Swinburn & Egger, 2004, p. 736).

Environment

Given that the explosion in obesity rates has occurred mainly in the last 30 years (Hill, et al., 2003), many scientists agree that this sudden rise must be due to environmental factors

(Birch, 1999; Hill et al.). Specifically, we see lower energy expenditure due to a more sedentary lifestyle and higher energy intake, facilitated by easy availability of calorie-dense meals in huge portions (French et al., 2001; Hill & Peters, 1998; Hill et al.).

A number of studies have been conducted to research the relationship of environmental characteristics, food choice and food intake: Environmental characteristics such as package size of foods in supermarkets, prevalence of all-you-can-eat restaurants, and meal sizes served in restaurants have been suggested to shed light on the French paradox (Rozin, Kabnick, Pete, Fischler & Shields, 2003)—the apparently paradoxical finding that the French population seems to be slimmer than U.S. Americans despite eating more high-fat cheese and drinking more red wine. Rozin and colleagues suggested that the finding is not so paradoxical if one considers the smaller package sizes of food in supermarkets, and the smaller portion sizes in restaurants and cookbook recipes in France. This so-called unit bias has been investigated by Geier and colleagues (Geier, Rozin, & Doros, 2006): They found that people were constant on the number of candies they ate independent of whether they were eating normal-sized or extra-large goodies, consequently eating more when bigger sizes were present.

Brian Wansink (e.g., 2004) demonstrated the effect of environment in a series of experiments, including the "bottomless soup bowl" experiment, in which participants were asked to eat soup in a 20-minute session. However, the soup bowls refilled automatically and thus were never empty. At the end of the experiment participants reported having eaten as much as the size of the soup bowl would hold. They also did not feel fuller than those participants with a normal, not self-refilling soup bowl, even though they had eaten much more (Wansink, Painter, & North, 2005). In another study, Wansink demonstrated how portion size is affected by package size: the bigger the spaghetti box, the bigger the portion that is served from it (Wansink, 1996). Barbara Rolls has shown a similar effect for food size: Participants were satisfied for the same length of time with low-caloric-density food as they

were with high-caloric-density food—if the volume was the same (Bell & Rolls, 2001; Rolls et al., 1999; Rolls, Bell, & Waugh, 2000).

These studies show people do not necessarily rely on their subjective feeling of "fullness" to decide when to end a meal but rather on environment cues such as plate or food size, or number of units. In a world that is "supersized" (e.g., the size of regular Coca Cola bottles increased from 6.5 ounces in 1916 to 32 ounce bottles sold for individual consumption in the U.S. today; French et al., 2001), this strategy can lead to overconsumption. A link from perceived environment structure to behavior was established by Kurzenhäuser and Hertwig (2007): They showed that the cues most salient for food choice of cafeteria lunchers were related to the environment structure of the cafeteria, including the variety of foods offered and the length of queues for specific foods.

Social Environment

Food choice and intake are not only about plate or package size, bottomless soup bowls, or variety—it is also important who makes the food decisions and who keeps you company while you eat. Humans learn to select food under the close supervision and instruction of elders (Rozin, 1990)—and now also in schools (e.g., Keirle & Thomas, 2000). Many if not all of the food choices during the first years of life are influenced by the parents, making food a center for parent–child interaction (Rozin, 1996). There is extensive literature on the development of food preferences and the influence of parents on preference formation and food selection of their children (for a review see Birch, 1999). Birch reported that children have a predisposition for certain tastes that affect their behavioral responses to food; however, these preferences can be readily altered through experience with food and eating. For infants and children in particular, eating is a social event and others, especially parents, have a major impact on food acceptance. For example, by providing foods such as desserts as a reward for eating a less-enjoyed food, parents further decrease the liking for the less-

enjoyed food and increase the liking for the reward (Birch, Birch, Marlin, & Kramer, 1982; Birch, Marlin, & Rotter, 1984).

From her review, Birch (1999) concluded that food preferences are learned via experience, and she emphasized the critical role of the environment for determining the adequacy of diets; because food preferences are learned, they are modifiable. The best chance for parents to foster healthy eating patterns in their children is to accustom them to an appropriate diet when they are young. Birch (1980) also showed that not only parents, but also peers can influence food choice and preference formation in preschool-aged children. However, this relationship could not be shown for third graders or undergraduates (Rozin, Riklis, & Margolis, 2004).

Food intake is also influenced by the mere presence of others. For example, De Castro (1994) has shown that meals eaten together with another person were 33% larger than those eaten alone; amount of consumption increases with the number of people at the table (De Castro & Brewer, 1992); this relationship has been replicated for preschool-aged children (Lumeng & Hillman, 2007). People eat more when familiar and friendly people keep them company. In contrast, meal consumption decreases in situations where unfamiliar people are present (Chaiken & Pliner, 1990; Clendenen, Herman, & Polivy, 1994; Herman, Roth, & Polivy, 2003; Mori, Chaiken, & Pliner, 1987). Spouses' eating habits and food preferences converge in the first year of living together (Bove, Sobal, & Rauschenbach, 2003). Furthermore, obesity spreads in social networks over the years, suggesting that weight in the social environment influences what is perceived as an acceptable weight for the individual (Christakis & Fowler, 2007). Thus it is possible that if at Thanksgiving dinner one notices that a sibling has gained weight, one might start to find a couple of extra pounds also acceptable and decide to have a second serving of pumpkin pie.

On a society level, advertisements and marketing budgets have been suggested to foster childhood obesity, by marketing fast food restaurant temptations and sugar-loaded

breakfast cereals to children, who in turn badger their parents to buy this food for them (e.g., DuRant, Baranowski, Johnson, & Thompson, 1994; Kraak & Pelletier, 1998). Children are exposed to an estimated 10,000 food advertisements per year, of which 95% are campaigns for fast food, soft drinks, sugared cereal, and candy (Horgen, Choate, & Brownell, 2001). However, Saad (2006) argued that foods in advertisements targeted for children serve evolved gustatory preferences for sweet and salty tastes as well as high-fat food, and that this is the actual reason for their success, not their advertisement policies and marketing budgets. He proposed a thought experiment in which the "fictitious American Association for Raw Broccoli and Steamed Spinach" (p. 73) has unlimited funds to realize the most powerful advertisement campaign imaginable—would they become more successful than McDonald's? Probably not.

Decision Making in the Food Domain

The food environment has changed considerably since the time of the environment of evolutionary adaptedness (Birch, 1999), from the wilds roamed by hunter–gatherer societies to the supermarket aisles of today. Gigerenzer and colleagues (Gigerenzer et al., 1999) have suggested that people often make decisions by relying on simple rules of thumb, or heuristics, that include principles for guiding information or cue search, stopping search, and making a decision. In the Pleistocene, food was often scarce and heuristics directing food choice may have included search rules such as "first go to the patch where you found berries yesterday," rules to stop the search when "you have found the first patch with berries," and decision rules directing you what food items to avoid, such as "don't eat berries you have never seen before." Of course, the adaptations for food search and choice are complex mechanisms, but a great deal of progress was made when researchers started to look at models from behavioral ecology to study how humans forage for resources. For instance, the simple rules of thumb that animals apply to decide when to move from one food patch to the next also neatly explain

how humans search their environment for physical resources (Hutchinson, Wilke, & Todd, in press) or information (Wilke, Hutchinson, Todd & Czienskowski, manuscript in preparation).

Decision Processes Underlying Food Choice

Food choice is still an important and widely researched topic today, not only because of an ever increasing variety of available foods (Schwartz, 2004), but also because it is a choice people face constantly, making around 200 food decisions a day (Wansink, 2006; Wansink & Sobal, 2007). A lot of research on human food choice today is about understanding underlying motives for food choice, such as attitudes toward and values pertaining to food (e.g., Steptoe, Pollard, & Wardle, 1995). It has been shown that concerns about body weight, ethics, or artificial ingredients can explain the avoidance of certain foods (Mooney & Walbourn, 2001), and people who are concerned with their health are more likely to choose a healthy snack (Roininen et al., 2001; Zandstra, De Graaf, Van Staveren, 2001). However, there is little research on how different attitudes, values, knowledge, and environmental factors are integrated to make a decision. Weighting each characteristic of a food by its relevance to the decision maker, adding all this information up to a sum, and then choosing between foods based on these sums seems to be a widespread understanding of decision making in the food literature (Eertmans, Victoir, Notelaers, Vansant, & Van den Bergh, 2005; Glanz, Basil, Maibach, Goldberg, & Snyder, 1998; Michela, & Contento, 1986; for a review of food choice models see Stafleu, De Graaf, Van Staveren, & Schroots, 1991).

However, such a decision process takes a lot of energy and mental capacity. It is questionable whether people really go through all this effort to decide between foods, and weighting and adding as a model of human decision has been criticized (Dawes, 1979; Einhorn & Hogarth, 1975). Instead, Gigerenzer and colleagues (Gigerenzer et al., 1999) proposed simple strategies that take into account the assumption of bounded rationality, a theory of how cognitive systems constrained in the amount of resources available to them

(e.g., time, computational power) solve the problems they are faced with in an efficient manner. This perspective assumes that people use little information for making a choice and rather than adding and weighting many pieces of information, they base their decisions on a few good reasons and make a decision that is good enough.

A recent study by Scheibehenne, Miesler, and Todd (in press) has shown empirically that a model that weights and adds a large number of pieces of information, based on nine factors from the Food Choice Questionnaire (a popular instrument for finding which factors influence food choice; Steptoe et al., 1995), predicted people's lunch choices about as well as did a lexicographic model that relies on one piece of information. This result suggests that people's food choice behavior can be explained with simple rules. However, the decision task in this study was a binary choice task in a laboratory setting. The benefit and use of simple rules for repeated choices as part of a long-term health behavior in the real world, such as selecting food during a weight loss diet, has yet to be tested.

Deciding How Much to Eat

Another important decision problem in the Western world today is the necessity to decide how much we eat. When food was scarce—during some seasons in the time of evolutionary adaptedness, or in the last years of World War II in Central Europe—there was no need for stopping rules for eating: Once a patch with a considerable amount of food was found, "eat as much as you can and take the rest with you" seems the most likely response. In our modern Western world, there is an overabundance of (energy-dense) foods. The old rules do not fit this new environment, leading those who adhere to them into overweight and obesity. Hill et al. (2003) suggested motivating people to make conscious behavior changes within the current environment, implying that there could be cognitive control of body weight based on education about energy intake and expenditure. But it seems that making people

aware is only part of the solution: Nutrition education has a history of being used in controlled trials to help people control their weight (e.g., Jeffery & French, 1999)—unsuccessfully.

From a psychological perspective on food choice that takes environment influences into account, a promising approach to healthier eating is to design environments that (1) provide information that can be evaluated to facilitate informed food choice, (2) include down-sized portions and calorie density in supermarkets and restaurants, thus helping people consume appropriate amounts of energy, and (3) provide simple rules for behavior (change) that help people adhere to those rules and (4) teach about beneficial cues for making decisions, such as preference predictions.

Outline of the Dissertation

This dissertation contributes to understanding cognitive mechanisms and environment characteristics that determine people's food choices. It comprises three manuscripts.

The first manuscript, "When Diets Last: Lower Cognitive Complexity Increases Probability of Staying on Diets," investigates the role of the cognitive complexity of diet rules in determining success of weight loss diets. The underlying assumption guiding this research is that many popular weight loss diets fail because they are too complicated from a cognitive point of view, meaning that dieters are not able to recall or apply the diet rules. The studies extend previous research on the influences of physical and social environments on food choice and amount eaten to the cognitive environment. The cognitive environment is defined as the explicit food decision rules defined by weight loss programs. The impact of excessive cognitive demands on diet adherence and dieters' perception of diet rule complexity and difficulty is investigated (1) from an environmental perspective, by analyzing diet environments (i.e., diet rules in diet books), and (2) from the perspective of the dieter, by evaluating information gathered in an online questionnaire. The results from the complexity analysis of the diet rules are compared to perceived difficulty reported by dieters in the online

study. Results support the expected trend: Dieters who perceive their diet rules as more difficult are 1.4 times as likely to quit their weight loss diet prematurely.

The second manuscript, "Meat Label Design: Effects on Stage Progression, Risk Perception, and Product Evaluation," looks at the impact of food labels on food evaluation. In two experiments we tested the impact of health-related meat labels on stage of behavior change toward considering food production and ingredients; on risk perception about meat-related illness; and on meat product evaluation, focusing on inter-individual differences in response to label exposure. We also examined how informational content and the context in which labels are assessed influence the evaluation of meat products. In Study 1, more non-intenders moved a stage forward if they were exposed to health-related labels than if they were in the control group. Further, the treatment group reported significantly higher risk perception after the experimental manipulation. In Study 2, informational content and the context of meat label presentation influenced the evaluation of a product, thus leading to a preference reversal effect. Only food labels that provide transparent and evaluable information about a meat product can influence consumers and allow them to make informed and responsible decisions.

The third manuscript, "Predicting Children's Meal Preferences: How Much Do Parents Know?," investigates prediction behavior concerning other people's food choices. In particular, we asked how well parents could predict their children's meal choices in an ecologically valid setting, and which cues described parents' predictions or could be used to improve prediction accuracy further. The cues tested included specific knowledge (prediction of own child's vs. other children's preferences), similarity (how similar parents and children were in their food preferences), and healthfulness (parents' vs. children's perceived healthfulness of foods as predictor for meal preference). Parents' prediction accuracy was as high as children's preference stability over time, suggesting that parents were as accurate as

possible in their predictions. Neither similarity nor perceived healthfulness could improve prediction accuracy of the majority of the parents.

This dissertation aims to shed more light on how information environments influence eating behavior, specifically in the studies conducted on dieting and food labels. It will also illuminate one aspect of food choice that has received little attention in previous studies on social environments, especially family environments: food preference prediction.

References

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckmann (Eds.), *Action control: From cognition to behavior* (pp. 11–39). Seattle, WA: Hogrefe & Huber.

Anderson, E. S., Winett, R. A., Bickley, P. G., Walberg-Rankin, J., Moore, J. F., Leahy, M., Harris, C. E., & Gerkin, R. E. (1997). The effects of a multimedia system in supermarkets to alter shoppers' food purchases. *Journal of Health Psychology, 2*, 209–223.

Armitage, C. J., & Conner, M. (1999). Distinguishing perceptions of control from self-efficacy: Predicting consumption of a low-fat diet using the Theory of Planned Behavior. *Journal of Applied Social Psychology, 29,* 72-90.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84,* 191–215.

Baskin, M. L., Ard, J., Franklin, F., & Allison, D. B. (2005). Prevalence of obesity in the United States. *Obesity Reviews, 6,* 5–7.

Becker, M. H. (Ed.). (1974). *The health belief model and personal health behavior.* Thorofare, NJ: Slack.

Bell, A. C., Ge, K., & Popkin, B. M. (2001). Weight gain and its predictors in Chinese adults. *International Journal of Obesity, 25*, 1079–1086.

Bell, E. A., & Rolls, B. J. (2001). Energy density of foods affects energy intake across multiple levels of fat content in lean and obese women. *The American Journal of Clinical Nutrition*, 73, 1010–1018.

Bettman, J. R., Payne, J. W., & Staelin, R. (1987). Cognitive considerations in designing effective labels for presenting risk information. In K. Viscusi & W. Magat (Eds.),

Learning about risk: Evidence on the economic responses to risk information (pp. 1–28). Cambridge, MA: Harvard University Press.

Birch, L. L. (1980). Effects of peer models' food choices and eating behaviors on pre-schoolers' food preferences. *Child Development, 51*, 489–496.

Birch, L. L. (1992). Children's preferences for high-fat foods. *Nutrition Reviews, 50,* 249–255.

Birch, L. L. (1999). Development of food preferences. *Annual Review of Nutrition, 19*, 41–62.

Birch, L. L., Marlin, D. W., & Rotter, J. (1984). Eating as the "means" activity in a contingency: Effects on young children's food preferences. *Child Development, 55,* 431-439.

Bjørner, T. B., Hansen, L. G., & Russell, C. S. (2004). Environmental labeling and consumers' choice—an empirical analysis of the effect of the Nordic Swan. *Journal of Environmental Economics and Management, 47*, 411–434.

Booth, D. A. (1994). *Psychology of nutrition.* London: Taylor & Francis.

Bove, C. F., Sobal, J., & Rauschenbach, B. S. (2003). Food choices among newly married couples: Convergence, conflict, individualism, and projects. *Appetite, 40*(1), 25–41.

Brownell, K. D., & Rodin, J. (1994). Medical, metabolic, and psychological effects of weight cycling. *Archives of Internal Medicine, 154,* 1325-1330.

Brownell, K. D., & Wadden, T. A. (1992). Etiology and treatment of obesity: Understanding a serious, prevalent, and refractory disorder. *Journal of Consulting and Clinical Psychology, 60,* 505–517.

Caswell, J. A., & Padberg, D. I. (1992). Toward a more comprehensive theory of food labels. *American Journal of Agricultural Economics, 74*, 460–468.

Chaiken, S., & Pliner, P. (1990). Eating, social motives, and self-presentation in women and men. *Journal of Experimental Social Psychology, 26,* 240–254.

Christakis, N. A., & Fowler, J. H. (2007). The spread of obesity in a large social network over 32 years. *New England Journal of Medicine, 357,* 370-379.

Clendenen, V. I., Herman, C. P., & Polivy, J. (1994). Social facilitation of eating. An experimental study. *Appetite, 23,* 1–13.

Conner, M., & Armitage, C. J. (2002). The social psychology of food. Buckingham, UK: Open University Press.

Dawes, R. M. (1979). The robust beauty of improper linear models in decision making. *American Psychologist, 34,* 571-582.

De Castro, J. M. (1994). Family and friends produce greater social facilitation of food intake than other companions. *Physiology & Behavior, 56*, 445–455.

De Castro, J. M., & Brewer, E. (1992). The amount eaten in meals by humans is a power function of the number of people present. *Physiology & Behavior, 51,* 121–125.

De Garine, I. (1972). The socio-cultural aspects of nutrition. *Ecology of Food and Nutrition, 1*, 143–163.

Desor, J. A., Greene, L. S., & Maller, O. (1975). Preferences for sweet and salty in 9–15 year old and adult humans. *Science, 190*, 686–687.

Diamond, J. (2003). The double puzzle of diabetes. *Nature, 423,* 599–602.

Drewnowski, A. (1997). Taste preferences and food intake. *Annual Review of Nutrition, 17,* 237–253.

Drewnowski, A., Henderson, S. A., Driscoll, A., & Rolls, B. A. (1996). Salt taste perceptions and preferences are unrelated to sodium consumption in healthy older adults. *Journal of the American Dietetic Association, 96*, 471–474.

DuRant, R. H., Baranowski, T., Johnson, M., & Thompson, W. O. (1994). The relationship among television watching, physical activity, and body composition of young children. *Pediatrics, 94,* 449–455.

Eertmans, A., Victoir, A., Notelaers, G., Vansant, G., & Van den Bergh, O. (2006). The food choice questionnaire: Factorial invariant over western urban populations? *Food Quality and Preference, 17,* 344–352.

Einhorn, H. J., & Hogarth, R. M. (1975). Unit weighting schemes for decision making. *Organizational Behavior and Human Performance, 13,* 171-192.

Ezatti, M., Martin, H., Skjold, S., Van der Hoorn, S., & Murray, C. J. L. (2006). Trends in national and state-level obesity in the USA after correction for self-report bias: Analysis of health surveys. *Journal of the Royal Society of Medicine, 99,* 250–257.

Flegal, K. M., Carroll, M. D., Ogden, C. L., & Johnson, C. L. (2002). Prevalence and trends in obesity among US adults, 1999–2000. *Journal of the American Medical Association, 288,* 1723–1727.

Food Marketing Institute. (1996). *Trends in the United States: Consumer attitudes and the supermarket.* Chicago: Food Marketing Institute.

Foreyt, J. P., & Goodrick, G. K. (1995). The ultimate triumph of obesity. *Lancet, 346,* 135.

French, S. A., Story, M., & Jeffery, R. W. (2001). Environmental influences on eating and physical activity. *Annual Review of Public Health, 22,* 309–335.

Fry, J., & Finley, W. (2005). The prevalence and costs of obesity in the EU. *Proceedings of the Nutrition Society, 64,* 359–362.

Geier, A. B., Rozin, P., & Doros, G. (2006). Unit bias. A new heuristic that helps explain the effect of portion size on food intake. *Psychological Science, 17*(6), 521–525.

Gigerenzer, G., Todd, P. M., & the ABC Research Group. (1999). *Simple heuristics that make us smart.* New York: Oxford University Press.

Glanz, K., Basil, M., Maibach, E., Goldberg, J., & Snyder, D. (1998). Why Americans eat what they do: Taste, nutrition, cost, convenience, and weight control concerns as influences on food consumption. *Journal of the American Dietetic Association, 98,* 1118–1126.

Goldstein, D. G., & Gigerenzer, G. (2002). Models of ecological rationality: The recognition heuristic. *Psychological Review, 109*(1), 75–90.

Gollwitzer, P. M. (1999). Implementation intentions: Strong effects of simple plans. *American Psychologist, 54,* 493–503.

Gollwitzer, P. M., & Sheeran, P. (2006). Implementation intentions and goal achievement: A meta-analysis of effects and processes. *Advances in Experimental Social Psychology, 38,* 69-119.

Herman, C. P., Roth, D. A., & Polivy, J. (2003). Effects of the presence of others on food intake: A normative interpretation. *Psychological Bulletin, 129*(6), 873–886.

Higginson, C. S., Rayner, M. J., Draper, S., & Kirk, T. R. (2002). How do consumers use nutrition label information? *Nutrition & Food Science, 32*(4), 145–152.

Hill, J. O., & Peters, J. C. (1998). Environmental contribution to the obesity epidemic. *Science, 280*(5368), 1371–1374.

Hill, J. O., Wyatt, H. R., Reed, G. W., & Peters, J. C. (2003). Obesity and the environment: Where do we go from here? *Science, 299,* 853–855.

Horgen, K. B., Choate, M., & Brownell, K. D. (2001). Television food advertising: Targeting children in a toxic environment. In D. G. Singer, & J. L. Singer (eds.), *Handbook of children and the media* (pp. 447–461). Thousand Oaks, CA: Sage.

Hutchinson, J. M. C., Wilke, A., & Todd, P. M. (in press). Patch leaving in humans: Can a generalist adapt its rules to dispersal of items across patches? Animal Behaviour.

Jeffery, R. W., Drewnoswski, A., Epstein, L. H., Stunkard, A. J., Wilson, G. T., & Wing, R. R. (2000). Long-term maintenance of weight loss: Current status. *Health Psychology, 19*(1, suppl), 5–16.

Jeffery, R. W., & French, S. A. (1999). Preventing weight gain in adults: The pound of prevention study. *American Journal of Public Health, 89,* 747–751.

Johnson, E. J., & Goldstein, D. (2003). Do defaults save lives? *Science, 302,* 1338–1339.

Keirle, K., & Malcolm, T. (2000). The influence of school health education programmes on the knowledge and behaviour of school children towards nutrition and health. *Research in Science & Technological Education, 18,* 173-190.

Kopelman, P. G. (2000). Obesity as a medical problem. *Nature, 404,* 635–643.

Kortt, M., Langley, P., & Cox, E: (1998). A review of cost-of-illness studies on obesity. *Clinical Therapeutics, 20*, 772–779.

Kraak, V., & Pelletier, D. L. (1998). The influence of commercialism on the food purchasing behavior of children and teenage youth. *Family Economics and Nutrition Review, 11,* 15–24.

Kurzenhäuser, S., & Hertwig, R. (2007). *Food choice in the cafeteria: Environmental and preferential determinants*. Manuscript submitted for publication.

Leathwood, P. D., Richardson, D. P., Straeter, P., Todd, P. M., & Trijp, H. C. M. van. (in press). Consumer understanding of nutrition and health claims: Sources of evidence. *British Journal of Nutrition*.

Leventhal, H., Singer, R., & Jones, S. (1965). Effects of fear and specificity of recommendation upon attitudes and behavior. *Journal of Personality and Social Psychology, 2,* 20-29.

Levy, A., Mathews, O., Stephenson, M., Tenney, J., & Schucker, R. (1985). The impact of a nutrition information program on food purchases. *Journal of Public Policy and Marketing, 4*(1), 1–13.

Lumeng, J. C., & Hillman, K. H. (2007). Eating in larger groups increases food consumption. *Archives of Disease in Childhood, 92,* 384–387.

McGinnis, J. M., & Foege, W. H. (1993). Actual causes of death in the United States. *Journal of the American Medical Association, 270*(18), 2207–2212.

Mela, D. J. (1992). *Dietary fats.* Essex, UK: Elsevier Science.

Michela, J. L., & Contento, I. R. (1986). Cognitive, motivational, social, and environmental influences on children's food choices. *Health Psychology, 5,* 209-230.

Mokdad, A. H., Marks, J. S., Stroup, D. F. & Gerbeding, J. L. (2004). Actual causes of death in the United States, 2000. *Journal of the American Medical Association, 291*(10), 1238–1245.

Mooney, K. M., & Walbourn, L. (2001). When college students reject food: Not just a matter of taste. *Appetite, 36,* 41–50.

Mori, D., Chaiken, S., & Pliner, P. (1987). Eating lightly and the self-presentation of femininity. *Journal of Personality and Social Psychology, 53,* 693–702.

National Heart, Lung, and Blood Institute Obesity Education Initiative Task Force Members. (1998). *Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults. The evidence report*. (NIH publication no. 98-4083). Bethesda, MD: National Institutes of Health.

Oxman, A. D., Thomson, M. A., Davis, D. A., & Haynes, R. B. (1995). No magic bullets: A systematic review of 102 trials of interventions to improve professional practice. *Canadian Medical Association Journal, 153*(10), 1423–1431.

Pasanisi, F., Contaldo, F., de Simone, G., & Mancini, M. (2001). Benefits of sustained moderate weight loss in obesity. *Nutrition, Metabolism, and Cardiovascular Disease, 11*(6), 401–406.

Powell, L. H., Calvin, J. E., III, & Calvin, J. E., Jr. (2007). Effective obesity treatments. *American Psychologist, 62*, 234–246.

Prentice, A. M., Jebb, S. A., Goldberg, G. R., Coward, W. A., Murgatroyd, P. R., Poppitt, S. D., & Cole, T. J. (1992). Effects of weight cycling on body composition. *American Journal of Clinical Nutrition, 56,* 209S-216S.

Prochaska, J. O., & DiClemente, C. C. (1983). Stages and processes of self-change of smoking: Toward an integrative model of change. *Journal of Consulting and Clinical Psychology, 51,* 390-395.

Prugger, C., & Keil, U. (2007). Entwicklung der Adipositas in Deutschland—Größenordnung, Determinanten und Perspektiven [Development of obesity in Germany—prevalence, determinants and perspectives]. *Deutsche medizinische Wochenschrift, 132,* 892–897.

Rogers, R. W. (1975). A protection motivation theory of fear appeals and attitude change. *Journal of Psychology, 91,* 93–114.

Roininen, K., Tuorila, H., Zandstra, E. H., De Graaf, C., Vehkalahti, K., Stubenitsky, K., et al. (2001). Differences in health and taste attitudes and reported behavior among Finnish, Dutch, and British consumers: A cross-cultural validation of health and taste attitude scales (HTAS). *Appetite, 37,* 33–45.

Rolls, B. J., Bell, E. A., & Waugh, B. A. (2000). Increasing the volume of a food by incorporating air affects satiety in men. *The American Journal of Clinical Nutrition, 72,* 361–368.

Rolls, B. J., Bell, E. A., Castellanos, V. H., Chow, M., Pelkman, C. L., & Thorwart, M. L. (1999). Energy density but not fat content of foods affected energy intake in lean and obese women. *The American Journal of Clinical Nutrition, 69,* 863–871.

Rozin, P. (1990). Development in the food domain. *Developmental Psychology, 26*(4), 555–562.

Rozin, P. (1996). Towards a psychology of food and eating: From motivation to module to model to marker, morality, meaning and metaphor. *Current Directions in Psychological Science, 5*(1), 18–24.

Rozin, P. (2000). Evolution and adaption in the understanding of behavior, culture, and mind. *American Behavioral Scientist, 43*(6), 970–986.

Rozin, P., Kabnick, K., Pete, E., Fischler, C., & Shields, C. (2003). The ecology of eating: smaller portions sizes in France than in the United States help explain the French paradox. *Psychological Science, 14*(5), 450–454.

Rozin, P., Riklis, J., & Margolis, L. (2004). Mutual exposure or close peer relationships do not seem to foster increased similarity in food, music or television program preferences. *Appetite, 42,* 41–48.

Rozin, P., & Vollmecke, T. A. (1986). Food likes and dislikes. *Annual Review of Nutrition*, *6*, 433–456.

Saad, G. (2006). Blame our evolved gustatory preferences. *Young Consumers, 3,* 72–75.

Scheibehenne, B., Miesler, L., & Todd, P. M. (in press). Fast and frugal food choices: Uncovering individual decision heuristics. *Appetite*.

Schwartz, B. (2004). *The paradox of choice. Why more is less.* New York: Harper Collins.

Schwarzer, R. (1992). Self- efficacy in the adoption and maintenance of health behaviours: Theoretical approaches and a new model. In R. Schwarzer (Ed.), *Self-efficacy: Thought control of action* (pp.217-243). Washington, DC: Hemisphere.

Schwarzer, R., & Renner, B. (2000). Social-cognitive predictors of health behavior: action self-efficacy and coping self-efficacy. *Health Psychology, 19,* 487-495.

Schwarzer, R., Schüz, B., Ziegelmann, J. P., Lippke, S., Luszczynska, A., & Scholz, U. (2007). Adoption and maintenance of four health behaviors: Theory-guided longitudinal studies on dental flossing, seat belt use, dietary behavior, and physical activity. *Annals of Behavioral Medicine, 33*(2), 156–166.

Seidell, J. C. (1996). The impact of obesity on health status: Some implications for health care costs. *International Journal of Obesity, 19*(Suppl 6)*,* S13–S16.

Sherman, P. W., & Billing, J. (1999). Darwinian gastronomy: Why we use spices. *BioScience, 49*(6), 453–463.

Simon, H. A. (1956). Rational choice and the structure of the environment. *Psychological Review, 63,* 129–138.

Stafleu, A., De Graaf, C., Van Staveren, W. A., & Schroots, J. F. (1991). A review of selected studies assessing social-psychological determinants of fat and cholesterol intake. *Food Quality and Preference, 3,* 183–200.

Steptoe, A., Pollard, T. M., & Wardle, J. (1995). Development of a measure of the motives underlying the selection of food: The food choice questionnaire. *Appetite, 25,* 267–284.

Swinburn, B., & Egger, G. (2004). The runaway weight gain train: Too many accelerators, not enough brakes. *British Medical Journal, 329,* 736–739.

Taubes, G. (1998). As obesity rates rise, experts struggle to explain why. *Science, 280*(5368), 1367–1368.

Utz, R. L. (2004). *Obesity in America, 1960–2000.* Unpublished doctoral dissertation, University of Michigan.

Vidal, J. (2002). Updated review on the benefits of weight loss. *International Journal of Obesity Related Metabolic Disorders, 26*(Suppl 4), S25–S28.

Wansink, B. (1996). Can package size accelerate usage volume? *Journal of Marketing, 60*(3), 1–14.

Wansink, B. (2004). Environmental factors that increase the food intake and consumption volume of unknowing consumers. *Annual Review of Nutrition, 24,* 455–479.

Wansink, B. (2006). *Mindless eating—Why we eat more than we think.* New York: Bantam-Dell.

Wansink, B., Painter, J. E., & North, J. (2005). Bottomless bowls: Why visual cues of portion size may influence intake. *Obesity Research, 13,* 93–100.

Wansink, B., & Sobal, J. (2007). Mindless eating. The 200 daily food decisions we overlook. *Environment and Behavior, 39*(1), 106–123.

Weinstein, N. D. (1993). Testing four competing theories of health-protective behavior. *Health Psychology, 12,* 324–333.

Wilke, A., Hutchinson, J. M. C., Todd, P. M., & Czienskowsi, U. (in preparation). Fishing for the right words: Human foraging behavior in external and internal search tasks.

Wing, R. R., Jeffery, R. W., & Hellerstedt, W. L. (1995). A prospective study of effects of weight cycling on cardiovascular risk factors. *Archives of Internal Medicine, 155,* 1416-1422.

World Health Organization. (1998). *Obesity: Preventing and managing the global epidemic.* Geneva: World Health Organization.

Zandstra, E. H., De Graaf, C., & Van Staveren, W. A. (2001). Influence of health and taste attitudes on consumption of low- and high-fat foods. *Food Quality and Preference, 12,* 75–82.

Manuscript 1

When Diets Last: Lower Cognitive Complexity Increases Diet Adherence

Mata, J., Todd, P. M., & Lippke, S. (in preparation). When diets last: Lower cognitive complexity increases diet adherence.

Running Head: COGNITIVE COMPLEXITY IN DIETS

When Diets Last: Lower Cognitive Complexity of Rules Increases Diet Adherence

Jutta Mata [1, 2], Peter M. Todd [1, 3], Sonia Lippke [4]

[1] Center for Adaptive Behavior and Cognition
Max Planck Institute for Human Development
Lentzeallee 94
14195 Berlin, Germany
jmata@mpib-berlin.mpg.de

[2] International Max Planck Research School "The Life Course: Evolutionary and Ontogenetic Dynamics"

[3] Cognitive Science Program
Indiana University, Bloomington
1101 E. 10th Street
Bloomington, IN 47405, USA
pmtodd@indiana.edu

[4] Department of Health Psychology
Freie Universität Berlin, Germany
Habelschwerdter Allee 45
14195 Berlin, Germany
slippke@fu-berlin.de

Corresponding author:
jmata@mpib-berlin.mpg.de (Jutta Mata)

Not for publication:
Phone: ++49 – 30- 82406-698
Fax: ++49 – 30- 82406-394

Abstract

We investigated the impact of the cognitive complexity of diet rules on adherence to weight loss programs. We asked whether popular weight loss diets can fail at the individual level if they are too complicated from a cognitive perspective, meaning that dieters are not able to recall or process all the information required for deciding what to eat. The impact of cognitive demands on diet adherence, and dieters' perception of diet rule complexity were assessed from an environmental perspective by analyzing diet rules in books, and from the cognitive perspective by giving 1,136 dieters a longitudinal online questionnaire. We measured perceived rule complexity in two popular weight loss diets, controlling for other factors known to influence adherence. Previous diet behavior, self-efficacy, planning, and perceived rule complexity predicted an increased risk of quitting the diet prematurely, with self-efficacy and complexity being the strongest factors.

Introduction

People have been found to make food decisions that follow simple rules (Gigerenzer, Todd, & the ABC Research Group, 1999; Scheibehenne, Miesler, & Todd, in press), thus, it may be easier to adhere to simple rather than complex eating rules. Whether and how the complexity of eating rules prescribed by weight loss diets affects diet adherence has yet to be studied. In this article we investigate the cognitive complexity of different popular diet programs, both objectively and subjectively, and study how it affects adherence to a weight loss program.

Diet adherence is vital to understand, because overweight and obesity are becoming a costly health problem in the Western world (e.g., Brownell & Wadden, 1992), and prevalence of obesity is still rising (e.g., Ezatti, Martin, Skjold, Van der Hoorn, & Murray, 2006; World Health Organization, 1998). Weight loss diets are a popular remedy; as much as 42% of German women and 22% of German men are dieting or engage in restrained eating (Westenhoefer, 2001). Numbers in the United States are similar (e.g., Kruger, Galuska, Serdula, & Jones, 2004). Yet few dieters are successful (Wadden & Foster, 2000), and maintaining weight loss over time seems even more difficult (Jeffery et al., 2000). In fact, many people return to or even exceed their original weight within a few years (e.g., Crawford, Jeffery, & French, 2000).

Numerous studies have shown that socio-cognitive factors, such as self-efficacy, intention, and planning (Schwarzer et al., 2007), as well as past behavior, for example, number of previous diet attempts, predict diet adherence (for a review see Teixeira, Going, Sardinha, & Lohman, 2005). One aspect that has been rarely considered in models of health behavior change is the role of environment factors, which food researchers have repeatedly shown to be significant in other contexts. Rozin and colleagues demonstrated the importance of environment characteristics for understanding the French paradox, the finding that despite a

higher consumption of fatty foods and wine, French people are leaner than Americans. They argued that this surprising French leanness arises in part from environment features such as smaller size of food packages or greater time taken for eating in France (Rozin, Kabnick, Pete, Fischler, & Shields, 2003). Another example is portion size, as Wansink (1996) demonstrated: The bigger the package size of spaghetti or other foods, the more people serve themselves (for an overview of environmental influences on food choice see Wansink, 2004). Kurzenhäuser and Hertwig (2007) established a link between perceived environment structure and behavior, showing that the food choice cues lunchers perceived as most salient were related to the environment structure of their cafeteria, including variety of foods offered and queue length.

In this study we extend this idea of the influence of cultural and physical factors to the cognitive environment and focus on health behavior change in dieting rather than on eating more generally. Our cognitive environment refers to the diet rules of a weight loss plan, because they represent a substantial part of the information that has to be processed to eat in accordance with a diet's rules. We analyze the structure of this cognitive environment and investigate its impact on weight loss diet adherence.

The complexity of a task has been defined as the result of the "attentional, memory, reasoning, and other information processing demands imposed by the structure of the task" (Robinson, 2001, p. 29). Research on concept learning has demonstrated that more complex concepts are harder to learn (Feldman, 2003). Robinson further showed that an objectively more complex task was also rated as more complex by participants. Cognitive resources demanded by the process of following diet rules are especially important to dieters, because dieters have been found to perform worse on cognitive tasks than people who are not trying to lose weight (Kemps, Tiggemann, & Marshall, 2005; Vreugdenburg, Bryan, & Kemps, 2003). While dieters and non-dieters performed equally well on general Wechsler intelligence tests (Wechsler, 1997), dieting seems to selectively impair working memory, affecting, for

example, performance on mental arithmetic (Vreugdenburg et al., 2003) or word length tasks (Shaw & Tiggemann, 2004). Cognitive processes involved in the mental arithmetic task (adding two numbers while occupying working memory by repeating a word every second) could be comparable to keeping track of calories in weight loss diets while handling daily life tasks. Similarly, word length tasks, where word lists have to be recalled after some delay, could tap into the same memory processes that dieters have to use. It has been argued that these dieting-induced cognitive deficits result from the effort spent on the operation of psychological mechanisms, such as preoccupying cognitions (Kemps et al., 2005; Vreugdenburg et al., 2003), which reduce resources available for controlling eating behavior or for addressing other demands, such as cognitive tasks.

The underlying assumption guiding our research is that if rules are too complicated from a cognitive point of view, dieters will be less likely to remember and process all necessary information and have more difficulty to apply them. Based on this assumption, we test whether the cognitive complexity of diet rules predicts how long people stick to their diet plans. To answer this question it is important to understand both the demands of the cognitive environment and its fit with the cognitive ability of the dieter, that is, both the objective and the perceived complexity of the diet rules.

Research Questions

Because cognitive complexity of diet rules has not been studied previously, we first establish whether weight loss diets differ objectively in the cognitive demands they pose on the dieter. Second, we ask if such differences are reflected in dieters' perceptions of the cognitive complexity of their diets and in the actual rules they use to lose weight. Finally, we assess whether these differences vary in their influence on dieters' adherence to their diet plan.

Based on the literature reviewed above, we propose the following hypothesis: Cognitive complexity is a significant predictor for the length of diet adherence, in addition to socio-cognitive factors of behavior change. We test this hypothesis via an analysis of particular diet programs and an online study of the perceptions and behavior of a set of dieters.

Method

Environment Analysis

We analyzed two of the most frequently used weight loss diet programs, Weight Watchers and Brigitte, via the corresponding bestselling books according to www.amazon.de (retrieved June 22, 2006; see Dost, 2004; Gerlach, Klosterfelde-Wentzel, & Khaschei, 2003). Brigitte is a recipe diet designed by one of Germany's most popular women's magazines that provides recipes for every meal of the day and shopping lists. Weight Watchers assigns point values to every food and instructs dieters to eat only a certain number of points per day; points can be compensated for with physical activity or partly saved up to offset a special celebration. The two diets thus differ considerably in the cognitive processing dieters must use to follow them.

All the rules from each book were individually assessed on two dimensions: (1) "declarative complexity" measured the number of information units (defined below) contained in the assessed rules, representing the total amount of information that had to be remembered; (2) "computational complexity" counted how many values (e.g., number of points) dieters had to keep track of, representing arithmetic processing tasks. The amount of information that had to be remembered in order to eat in accordance with the diet rules was coded into information units, defined as the smallest parts of a sentence that cannot be divided further without losing their meaning. For example, the rule "don't eat sugar" was divided into the verb "don't eat" and the noun "sugar," therefore, two information units.

Online Study

Design

Our online Internet study was based in Germany and designed with three measurement points, each 4 weeks apart. The study was programmed in HTML, with page linkage and data administration done with the software *dynQuest* (Rademacher & Lippke, in press). The only restriction for participants to enter the study was that they had to be currently intending to lose weight; when they had started their diet or what kind of weight loss program they were following did not matter. This method allowed us to study participants in their natural weight loss context (cf. Foster et al., 2003). We chose the time window of 8 weeks because it was brief enough to include and promptly assess dieters who had short time goals or wanted to lose little weight, but long enough to also document changes in long-term dieters.

Measures

Perceived complexity. Participants wrote down all the diet rules they were currently using. Cognitive complexity of these rules was measured in information units, using the same categorization system as for the environment analysis; two independent raters agreed on 92% of the categorizations. Rules were analyzed for a randomly drawn sub-sample of 225 participants, 75 per diet. Perceived computational complexity was assessed by asking, for every rule participants had named, how complicated or complex they found it to use this rule (adapted from Robinson, 2001). Perceived computational complexity did not significantly correlate with the analyzed complexity of the diet rules with r=.05, p=.51. Perceived declarative complexity was measured with the one item “How difficult was it for you to remember your diet rules during the first weeks?” offering five answer options, from very easy to very difficult. Perceived declarative complexity correlated with the analyzed declarative complexity of the diet rules, r=0.19, p<.001.

Diet goals. Dieters were asked how long they were planning to stick to their diet rules. They could answer with number of days, weeks, months, or years, or select "permanently" or "until I reach my goal weight."

Self-efficacy. Self-efficacy was assessed by asking dieters to rate three statements, such as "I am sure that I can stick to my weight loss program even if I need a long time to develop the necessary routines," on a 4-point scale, from disagree to strongly agree (adapted from Schwarzer et al., 2007); Cronbach's α=0.63.

Intentions. Intentions were measured with three statements, such as "I intend to eat in accordance with my diet's rules," each on a 4-point scale (adapted from Schwarzer et al., 2007); Cronbach's α=0.74.

Planning. How precisely dieters had planned their diet was measured by asking participants to rate six sentences (on a 4-point scale, from disagree to strongly agree), such as "I have planned in detail during which meals or on which occasions I will stick to my diet's rules" (adapted from Schwarzer et al., 2007); Cronbach's α=0.74.

Previous diet behavior. Participants were asked to state for eight popular diets whether they had followed them before, and how often; experiences with up to five other diets could be stated if applicable.

Demographics. Dieters were asked for their age, sex, their school and professional education, occupation at the time, height, and current weight.

Time on current diet. For those dieters still following their diet at the last measurement point, we added the time passed between first and third measurement to the length of diet adherence stated at the first measurement point. For those who had stopped their diet during the course of our study, we used their estimate of how long they had been on the diet in total. We used time on the current diet as our main dependent variable because it is an alternative means of measuring weight loss success: higher attrition—equivalent to less time spent on a diet—goes along with lower weight loss (Teixeira et al., 2005).

Goal attainment. Goal attainment of participants who stopped their diet during the study was measured by asking "Did you reach your desired weight?" and "Did you stick to the diet for as long as you had planned?" The five answer options ranged from "No, I have lost much less weight than I planned" to "I have lost much more weight than I planned"; analogous statements were used for sticking to the diet as long as planned (adapted from Berry, Danish, Rinke, Smiciklas-Wright, 1989).

Participants

Participants were recruited in four different ways: (1) from 23 German-language Internet chat rooms on weight loss, (2) via the website of a large-circulation German women's magazine, (3) from the members of a German Internet portal for psychological studies online and a health psychology portal, and (4) via the website of a German popular science magazine on psychology.

In total, 2,355 people who were actively trying to lose weight participated in the first measurement point. The 1,136 participants analyzed here were selected based on the following criteria: First, they had to be on Weight Watchers, Brigitte, or following their "own rules," that is, a diet individually designed by the participant; these three diets had sufficient number of dieters (1,846 overall, or 78.4% of the original sample) to yield reliable results. Second, they had to be female; male participants constituted only 5.8% of the sample and thus results on this subgroup would not be reliable. Third, they must not have ended their diet successfully during the study period; only 2.6% of the dieters stopped because they had reached their goal weight or had stayed on their diet as long as they had resolved to do so—again, this group is too small for meaningful results. Last, they had to provide their e-mail address since we wanted to study dieting change longitudinally, which 62% of the original sample did.

Participants in this sample (Tables 1 and 2) were slightly overweight, and better educated than the average German—33% had the equivalent of a master's degree, in comparison to approximately 15% in the German population (Klemm, 2001), and an additional 20% of participants were university students. The attrition rate at 41.7% was lower than that of other Internet studies on health behavior (cf. 59% reported by Schwarzer et al., 2007).

The 474 participants who did not respond at either the second or third measurement point (through attrition) weighed significantly less, were younger, had fewer previous diet attempts, and appeared to have had fewer years of school and professional education. However, effect sizes of the differences between attrition and participating groups were small and thus will not be interpreted.

Results

Comparison of environment, perceived, and analyzed complexity

Results of the environment analysis of diet books, ratings of perceived complexity, and analysis of the complexity of the rules dieters used are depicted in Table 3 and Figure 1. The environment analysis suggests that the Weight Watchers diet is more cognitively complex than Brigitte, both in declarative and computational complexity. *Perceived* declarative complexity and analyzed declarative complexity of the rules actually used reflect the results of the environmental analysis; both are higher in Weight Watchers. However, for computational complexity, Brigitte and Weight Watchers diet rules were not *perceived* to be significantly different, but the analyzed computational complexity of rules used was significantly higher for Brigitte followers than for Weight Watchers.

Perceived cognitive complexity as predictor for the length of diet adherence

In contrast to other weight loss studies where all participants started a program at the same time and evaluations of adherence are done after 6 months or a year, we did not have a

fixed starting point or time on the diet. Rather, we studied a time window of roughly 8 weeks within the course of participants' individual weight loss efforts. The time people were on their diets did not differ significantly between the three weight loss approaches, $F(2,1038)=0.44$, $p=.64$, $\eta^2=.00$; post-hoc tests also showed that there is no difference between any two of the three diets.

Using Cox regressions, we investigated which factors increased the likelihood that a dieter would quit a diet prematurely. Cox regressions model the time that passes until a specified event, such as quitting a diet, based on a number of predictor variables. Effects of predictors on dropout rate are often interpreted as odds; the greater the odds ratio (also referred to as hazard rate), the more likely the event is to occur. One major advantage of Cox regressions is that they make use of varying lengths of follow-up time periods in longitudinal studies: Data of participants with an as-of-yet unknown outcome, in our case participants still dieting at the last measurement point, are included in the hazard rate (Tabachnick & Fidell, 2007).

We ran hierarchical Cox regressions, once taking all dieters together and then separately for each of the three diet types. Variables were entered one at a time—first, type of diet, followed by previous behavior, self-efficacy, intention, planning, perceived computational complexity, and last, declarative complexity. To not bias results due to outliers, we cut off the 5% dieters with the shortest and the longest time on current diet.

Over all three diets (Table 4), each additional previous diet increased the odds of dropping out of the current diet by 4%. For a 1-unit increase in self-efficacy or planning, the odds ratio to quit was reduced significantly by 37% and 26%, respectively. Every unit increase in perceived declarative complexity raised the probability to quit by 6%, in perceived computational complexity by 36%. Intention was not a significant predictor of giving up. The comparison between diets shows that the likelihood to quit is 30% higher for people relying on their own rules than for those on Weight Watchers. The odds to give up Brigitte are also

lower than those of dieters on their own rules, although not significant. Figure 2 compares the survival curves of the diets.

The Cox regression model differed somewhat when the diets were analyzed individually (Table 5). For dieters on the Brigitte diet, previous diet behavior increased and self-efficacy decreased the odds of quitting. Each unit increase of perceived declarative complexity raised the odds of quitting by 33%. For dieters on Weight Watchers, only perceived computational complexity raised the probability of quitting, by 76%. Results for dieters on their own rules are similar to Brigitte dieters': Increased self-efficacy and concrete planning decreased the likelihood of giving up; increasing perceived declarative complexity raised the odds by 9%. In contrast to the strong impact of *perceived* complexity on diet adherence, the *analyzed* computational and declarative complexity of the rules that dieters said they used did not significantly predict giving up the weight loss program, neither across diets nor for each diet separately.

Discussion

In this study we extended previous research on how characteristics of the environment influence eating behavior by considering the cognitive environment, specifically the effect of weight loss rule complexity on diet adherence. We found that cognitive complexity, both objectively analyzed and subjectively perceived, differs between the three distinct diet programs considered here. Perceived cognitive complexity of diet rules partially corresponds to the analyzed complexity of the diet environment. Most importantly, we showed that perceived computational complexity for the Weight Watchers and perceived declarative complexity for the Brigitte and self-constructed diets significantly increased the probability that dieters would quit their diet.

We also found that higher self-efficacy and more concrete plans can increase the probability of diet adherence by a substantial amount, whereas intention did not have a

significant impact on diet adherence. It is possible that the intention to lose weight is a necessary precondition to start a diet. Since participants in our study were already dieting, they had very high intention scores (90% of participants rated their intention strength at 3 or 4 on a 4-point scale); thus there was little variance and intention could not be a meaningful predictor. Overall, popular weight loss diets kept dieters longer on their weight loss program than the rules that dieters had created themselves. The fact that the difference between the prescribed diet programs and own rules persists suggests that factors specific to relying on self-set rules further influence adherence, for example using rules that cannot be adhered to long-term (Knäuper, Cheema, Rabiau, & Borten, 2005).

Looking at the diets separately, for Brigitte dieters and those using their own rules, it is declarative complexity that raises the odds to quit, whereas in Weight Watchers it is computational complexity. These findings indicate that the variables influencing how long someone stays on a diet, vary between diets. It is understandable that perceived computational cognitive complexity is the strongest driving force we identified for adherence to Weight Watchers, since this is the diet that should theoretically be most computationally demanding, and also that it does not play a role for Brigitte, the recipe diet not placing much computational demand on followers. For dieters relying on their own rules, perceived declarative complexity influences adherence, suggesting that people designing their own rules do not sufficiently take into account how much information they realistically can remember during the course of a diet.

While perceived complexity influences diet adherence in the *direction* expected from our environment analysis, the two measures do not match up in expected *degree* of influence; also, analyzed complexity of rules used did not predict length of time dieters adhered to their diet. Thus though we showed the importance of the *perception* of simplicity of diet rules, we could not find any superiority of objectively simpler rules with the methods we used in this study. This could be because the sample of dieters' rules we analyzed was small, or the

analysis system we used was not appropriate for capturing aspects of complexity that really matter to dieters. We need to learn more about how dieters translate rules from diet books into their own rules and subsequently apply them.

There are various possible reasons why our environmental measures of the diet books did not correspond more closely to dieters' perceptions of rule complexity. The most probable cause is the considerable experience most of our participants already had with dieting: Over time, expertise grows and dieters are likely to remember details more easily or develop shortcuts for their rules (e.g., as suggested by Simon, 1979). Thus, the analyzed complexity of rules could be higher than that perceived by dieters because they had already simplified rules into personal guidelines for action. This would explain why perceived cognitive complexity was a better predictor than the objectively analyzed environmental complexity for staying on the current diet.

In our study we did not measure long-term success of different diet programs in terms of weight loss, but rather in terms of how long people stick to their programs. The underlying assumption is that being on a healthful diet longer increases the chance of losing weight or achieving a generally better health status. Literature reviews on long-term effects of dieting show that short-term diets do not generate lasting effects (Mann et al., 2007), and that successful weight loss programs involve long-lasting lifestyle change, including nutritional changes (Powell, Calvin, & Calvin, 2007). Thus, designing diet rules that can be adhered to for a long period or an entire lifetime could help limit the spread of overweight and obesity.

Limitations

Because our study results were obtained from a specific sample, dieting Internet users, they might not generalize to more diverse populations. Although Internet research enables reaching larger samples that are more diverse in age and socioeconomic status than standard

college populations (e.g., Goslin, Vazire, Srivastava, & Jon, 2004), Internet users are not wholly representative of the general population (cf., Skitka & Sargis, 2006).

Conclusions

This study bridged the disciplines of cognitive science and health psychology by integrating findings about cognitive complexity in a weight loss survey. Such cross-disciplinary approaches hold promise for obesity research (Teixeira et al., 2005). We have shown that the perceived complexity of eating decision rules affects how long dieters stick to their diet. This finding may also apply to other groups with medical conditions. For example, people who are recently diagnosed with diabetes and consequently need to change their eating style should also profit from simpler rules of behavior change.

To improve decision making, cognitive psychologists have identified sources of errors people make when accessing and processing complex information and developed techniques to help people overcome them (Sherman et al., 2000). Alternatively, we can design simple decision rules and environments that fit the capabilities of the human mind and thus do not incur errors so readily in the first place (Gigerenzer et al., 1999). For dieters, this would mean diet guidelines that are more easily translated into action without further simplification. This study highlights the importance of creating intervention rules that better match dieters' cognitive abilities and thus enhance their chance of weight loss success. By cutting down on cognitive complexity in diet plans, we may be able to help dieters cut down their weight as well.

References

Berry M., Danish S., Rinke W., Smiciklas-Wright H. (1989). Work-site health promotion: The effects of a goal-setting program on nutrition-related behaviors. *Journal of American Dietary Association, 89,* 914-920.

Brownell, K. D., & Wadden, T. A. (1992). Etiology and treatment of obesity: Understanding a serious, prevalent, and refractory disorder. *Journal of Consulting and Clinical Psychology, 60,* 505-517.

Crawford, D., Jeffery, R. W., & French, S. A. (2000). Can anyone successfully control their weight? Findings of a three year community-based study of men and women. *International Journal of Obesity, 24,* 1107-1110.

Dost, K. (2004). Weight Watchers. Der 4 Wochen Power Plan. Munich: Graefe & Unzer.

Ezatti, M., Martin, H., Skjold, S., Van der Hoorn, S., & Murray, C. J. L. (2006). Trends in national and state-level obesity in the USA after correction for self-report bias: Analysis of health surveys. *Journal of the Royal Society of Medicine, 99,* 250-257.

Feldman, J. (2003). The simplicity principle in human concept learning. *Current Directions in Psychological Science, 12*(6), 227-232.

Foster, G. D., Wyatt, H. R., Hill, J. O., McGuckin, B. G., Brill, C., Mohammed, B. S., Szapary, P. O., Rader, D. J., Edman, J. S., & Klein, S. (2003). Randomized trial of a low-carbohydrate diet for obesity. *The New England Journal of Medicine, 348*(21), 2082-2090.

Gerlach, S., Klosterfelde-Wentzel, M., & Khaschei, K. (2003). *Brigitte Ideal-Diät.* Munich: Wilhelm Goldmann.

Gigerenzer, G., Todd, P. M., & the ABC Research Group. (1999). *Simple heuristics that make us smart.* New York: Oxford University Press.

Gosling, S. D., Vazire, S., Srivastava, S., & John, O. P. (2004). Should we trust web-based studies? A comparative analysis of six preconceptions about Internet questionnaires. *American Psychologist, 59*, 93-104.

Jeffery, R. W., Drewnoswski, A., Epstein, L. H., Stunkard, A. J., Wilson, G. T., & Wing, R. R. (2000). Long-term maintenance of weight loss: Current status. *Health Psychology, 19*(1, suppl), 5–16.

Kemps, E., Tiggemann, M., & Marshall, K. (2005). Relationship between dieting to lose weight and the functioning of the central executive. *Appetite 45*, 287-294.

Klemm, K. (2001). Bildungsexpansion, Erfolge und Mißerfolge sowie Bildungsbeteiligung. In W. Böttcher, K. Klemm & T. Rauschenbach (Eds.), *Bildung und Soziales in Zahlen: Statistisches Handbuch zu Daten und Trends im Bildungsbereich* (pp. 331-342). Weinheim: Juventa.

Knäuper, B., Cheema, S., Rabiau, M., & Borten, O. (2005). Self-set dieting rules: Adherence and prediction of weight loss success. *Appetite, 44,* 283–288.

Kruger, J., Galuska, D. A., Serdula, M. K., & Jones, D. A. (2004). Attempting to lose weight: Specific practices among U.S. adults. *American Journal of Preventive Medicine, 26*(5), 402-406.

Kurzenhäuser, S., & Hertwig, R. (2007). *Food choice in the cafeteria: Environmental and preferential determinants*. Manuscript submitted for publication.

Mann, T., Tomiyama, J., Westling, E., Lew, A.-M., Samuels, B., & Chatman, J. (2007). Medicare's search for effective obesity treatments. Diets are not the answer. *American Psychologist, 62*(3), 220-233.

Powell, L. H., Calvin, J. E., III, & Calvin, J. E., Jr. (2007). Effective obesity treatments. *American Psychologist, 62*, 234-246.

Rademacher, J. D. M., & Lippke, S. (in press). Dynamic online surveys and experiments with the free open source software dynQuest. *Behavior Research Methods*.

Robinson, P. (2001). Task complexity, task difficulty, and task production: Exploring interactions in a componential framework. *Applied Linguistics, 22*(1), 27-57.

Rozin, P., Kabnick, K., Pete, E., Fischler, C., & Shields, C. (2003). The ecology of eating: Smaller portions sizes in France than in the United States help explain the French paradox. *Psychological Science, 14*(5), 450-454.

Scheibehenne, B., Miesler, L., & Todd, P. M. (in press). Fast and frugal food choices. Uncovering individual decision heuristics. *Appetite.*

Schwarzer, R., Schüz, B., Ziegelmann, J. P., Lippke, S., Luszczynska, A., & Scholz, U. (2007). Adoption and maintenance of four health behaviors: Theory-guided longitudinal studies on dental flossing, seat belt use, dietary behavior, and physical activity. *Annals of Behavioral Medicine, 33*(2), 156-166.

Shaw, J., & Tiggemann, M. (2004). Dieting and working memory: Preoccupying cognition and the role of the articulatory control process. *British Journal of Health Psychology, 9*(2), 175-185.

Sherman, A. M., Bowen, D. J., Vitolins, M., Perri, M. G., Rosal. M. C., Sevick, M. A., & Ockene, J. K. (2000). Dietary adherence: Characteristics and interventions. *Controlled Clinical Trials, 21*, 206-211.

Simon, H. A. (1979). Rational decision making in business organizations. *The American Economic Review, 69,* 493–513.

Skitka, L. J., & Sargis, E. G. (2006). The internet as psychological laboratory. *Annual Review of Psychology, 57*, 529-555.

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston: Allyn and Bacon.

Teixeira, P. J., Going, S. B., Sardinha, L. B., & Lohman, T. G. (2005). A review of psychosocial pre-treatment predictors of weight control. *Obesity reviews, 6,* 43-65.

Vreugdenburg, L., Bryan, J., & Kemps. E. (2003). The effect of self-initiated weight-loss dieting on working memory: The role of preoccupying cognitions. *Appetite, 41*, 291-300.

Wadden, T. A., & Foster, G. D. (2000). Behavioral treatment of obesity. *Medical Clinics of North America, 84,* 441-460.

Wansink, B. (1996). Can package size accelerate usage volume? *Journal of Marketing, 60*(3), 1-14.

Wansink, B. (2004). Environmental factors that increase the food intake and consumption volume of unknowing consumers. *Annual Review of Nutrition, 24,* 455-479.

Wechsler, D. (1997). *Wechsler adult intelligence scale—third edition.* San Antonio, TX: The Psychological Corporation.

Westenhoefer, J. (2001). Prevalence of eating disorder and weight control practices in Germany in 1990 and 1997. *International Journal of Eating Disorders, 29,* 477-481.

World Health Organization. (1998). *Obesity: Preventing and managing the global epidemic.* Geneva: World Health Organization.

Table 1

Characteristics of Participants

	All diets	Individual diets		
		Brigitte	Weight Watchers	Own rules
N (t1)	1,136	139	251	746
N (t2)	808	105	199	504
N (t3)	475	60	132	283
Adherence total % (t2 & t3)	67.9%	80.0%	72.2%	63.7%
Attrition total % (t2 & t3)	41.7%	45.3%	31.8%	44.4%
School education				
≤ 10-year school certificate	26.8%	23.3%	31.6%	25.8%
13-year school certificate	70.5%	73.7%	66.8%	71.2%
Professional education				
≤ 3-year vocational training	43.3%	41.5%	49.2%	41.6%
University students	21.3%	8.9%	20.8%	23.8%
Master's degree	31.8%	44.4%	26.4%	31.3%
Profession at the time				
Employed	54.7%	68.8%	61.4%	49.8%
In university or professional education	21.5%	13.8%	17.5%	24.4%
Home (housewife, unemployed, retired)	11.1	14.5%	8.9%	11.2%
Diet goals				
Time goal	53.2%	35.1%	56.1%	55.6%
Weight goal	46.8%	64.9%	43.9%	44.4%

Note. T1, t2, and t3 refer to the first, second, and third measurement point, respectively. All percentages in rows that do not add up to 100% belong to remaining categories.

Table 2

Participants' Characteristics

	All diets	Individual diets		
		Brigitte	Weight Watchers	Own Rules
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Age	32.80 (11.50)	39.2 (11.60)	33.7 (10.30)	31.3 (11.50)
Weight at t1 (BMI)	27.01 (7.07)	28.9 (12.50)	29.0 (6.00)	26.0 (5.70)
Weight loss (BMI; t3−t1)	-.53 (1.15)	-0.78 (0.99)	-0.54 (0.92)	-0.40 (0.86)
Time adhered to diet (weeks)	44.8 (124.00)	44.1 (172.00)	38.5 (45.30)	47.2 (132.40)
Self-efficacy	2.63 (0.68)	2.54 (0.65)	2.72 (0.66)	2.61 (0.68)
Intention	3.46 (0.54)	3.51 (0.53)	3.46 (0.52)	3.45 (0.55)
Planning	2.78 (0.81)	3.22 (0.67)	2.97 (0.72)	2.63 (0.82)
Number previous diet attempts	5.49 (4.32)	5.95 (4.01)	7.13 (4.24)	4.85 (4.25)

Note. *N* for each cell: see Table 1.

Table 3. Comparison of Different Complexity Measures Across Diets

	All diets	Individual diets			Effect sizes of differences between diets			Analysis of variance		
		Brigitte	Weight Watchers	Own rules	Brigitte–Weight Watchers	Brigitte–Own rules	Weight Watchers–Own rules	F ($df_{between}$, df_{within})	p	η^2
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	d	*d*	*d*			
Perceived declarative. complexity (t1)	1.69 (1.13)	1.72 (1.05)	1.95 (1.09)	1.59 (1.15)	0.21	0.12	0.32	F(2, 1099)=9.57	<.01	.02
Perceived computational. complexity (t1)	2.44 (0.75)	2.53 (0.72)	2.37 (0.68)	2.45 (0.78)	0.23	0.11	0.11	F(2, 1053)=2.06	.13	.00
Complexity rules written down: declarative (t1)	23.36 (11.06)	21.99 (10.60)	24.66 (12.14)	23.79 (10.73)	0.23	0.17	0.08	F(2, 212)=1.05	.35	.01
Complexity rules written down: computational (t1)	454.30 (632.67)	740.90 (658.57)	42.62 (100.86)	521.13 (693.56)	1.48	0.32	0.97	F(2, 218)=22.73	<.01	.17

Table 4

Cox Proportional Hazard Regression Predicting Diet Dropout, Over All Diets

Predictor variables	Wald statistic	Odds ratio	p	95% confidence interval of the odds ratio	
				Upper	Lower
Diet type	4.28		.12		
Brigitte–Own rules	0.71	0.78	.40	0.44	1.39
Brigitte - Weight Watchers	0.12	0.90	.73	0.48	1.66
Weight Watchers–Own rules	4.03	0.70	.05	0.49	0.99
Previous diet behavior	4.87	1.04	.03	1.004	1.07
Self-efficacy	16.72	0.63	<.01	0.50	0.78
Intention	0.45	1.10	.50	0.84	1.44
Planning	10.21	0.74	<.01	0.62	0.89
Perceived declarative complexity	4.02	1.06	.05	1.001	1.13
Perceived computational complexity	9.11	1.36	<.01	1.11	1.65

Note: Diet type is a categorical variable and thus results are reported as comparisons between each possible combination of two diets.

Table 5. Cox Proportional Hazard Regression Predicting Diet Dropout, Individual Diets

Predictor variables	Wald statistic	Odds ratio	p	95% confidence interval of the odds ratio	
				Upper	Lower
Previous diet behavior					
Brigitte	7.76	1.19	.01	1.05	1.35
Weight Watchers	0.29	1.02	.59	0.95	1.09
Own rules	2.99	1.03	.08	1.00	1.05
Self-efficacy					
Brigitte	4.40	0.36	.04	0.14	0.93
Weight Watchers	0.78	0.81	.38	0.51	1.29
Own rules	12.49	0.61	.001	0.46	0.80
Intention					
Brigitte	0.75	0.63	.39	0.22	1.81
Weight Watchers	2.76	1.75	.10	0.90	3.37
Own rules	0.00	1.01	.95	0.74	1.38
Planning					
Brigitte	3.41	0.41	.06	0.16	1.04
Weight Watchers	2.91	0.70	.09	0.46	1.06
Own rules	5.94	0.77	.02	0.62	0.95
Perceived declarative complexity					
Brigitte	4.89	1.33	.03	1.03	1.72
Weight Watchers	1.25	0.92	.26	0.80	1.07
Own rules	5.95	1.09	.02	1.02	1.17
Perceived computational complexity					

Predictor variables	Wald statistic	Odds ratio	p	95% confidence interval of the odds ratio	
				Upper	Lower
Brigitte	0.10	0.86	.75	0.35	2.14
Weight Watchers	6.22	1.76	.01	1.13	2.76
Own rules	3.56	1.25	.06	0.99	1.57

Figure Captions

Figure 1. Analyzed complexity of rules from diet environment, analyzed complexity of rules actually used, and perceived complexity of followed diets. The top panel shows results for declarative complexity, the lower panel for computational complexity (see text for definitions). The left-most graphs depict how many information units were contained in the Weight Watchers (WW) and Brigitte Diet (B) as found by the environment analysis of diet books. (Dieters who relied on their own rules—OR—by definition did not use a book, so their values here are 0.) The middle graphs depict the number of information units as analyzed from the rules that dieters stated they actually used. The right-most graphs show perceived cognitive complexity as reported by dieters on a scale of 1 to 5. Error bars are 95% confidence intervals.

Figure 2. Survival function comparing performance of the three different diet programs. Each curve describes how many dieters quit the particular diet prematurely as a function of time.

Figure 1. Environment, analyzed, and perceived complexity.

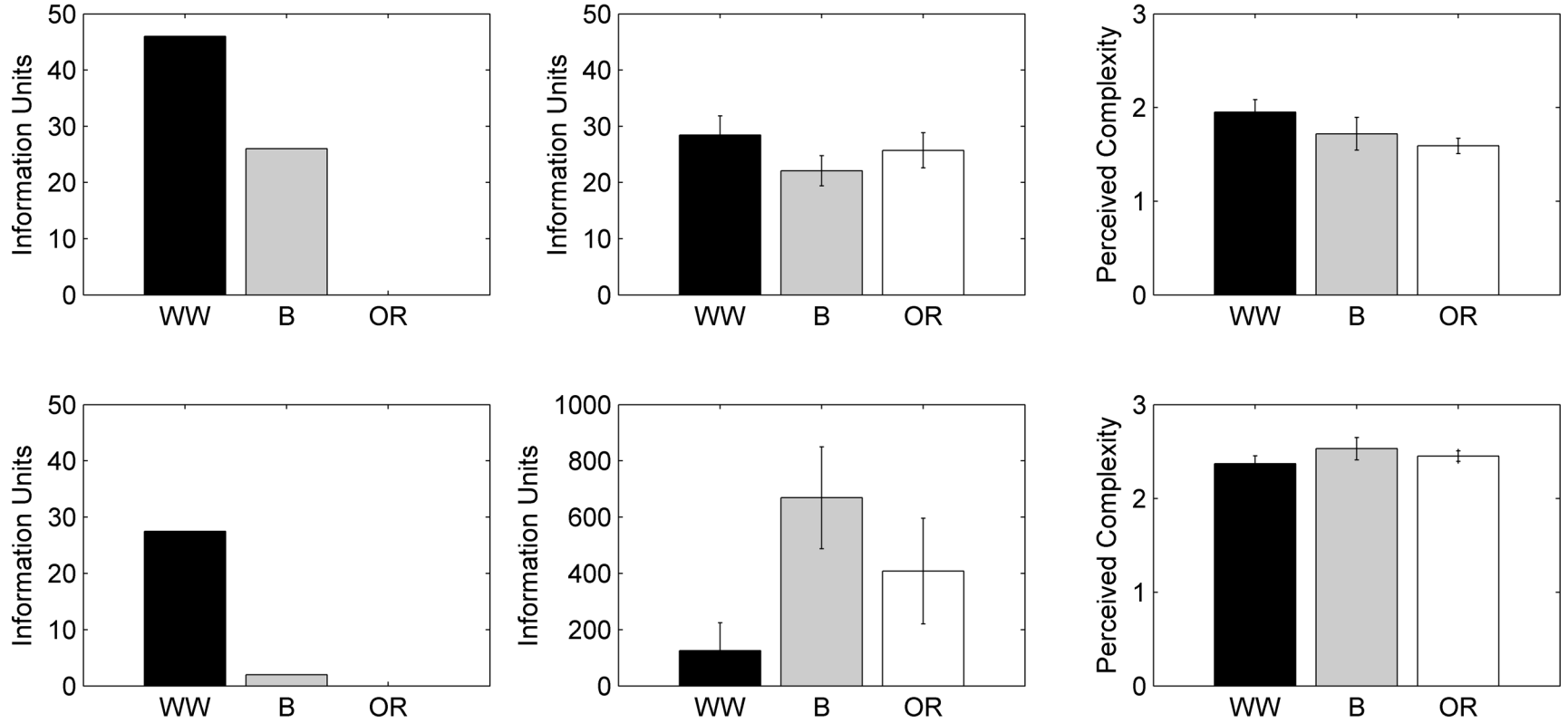
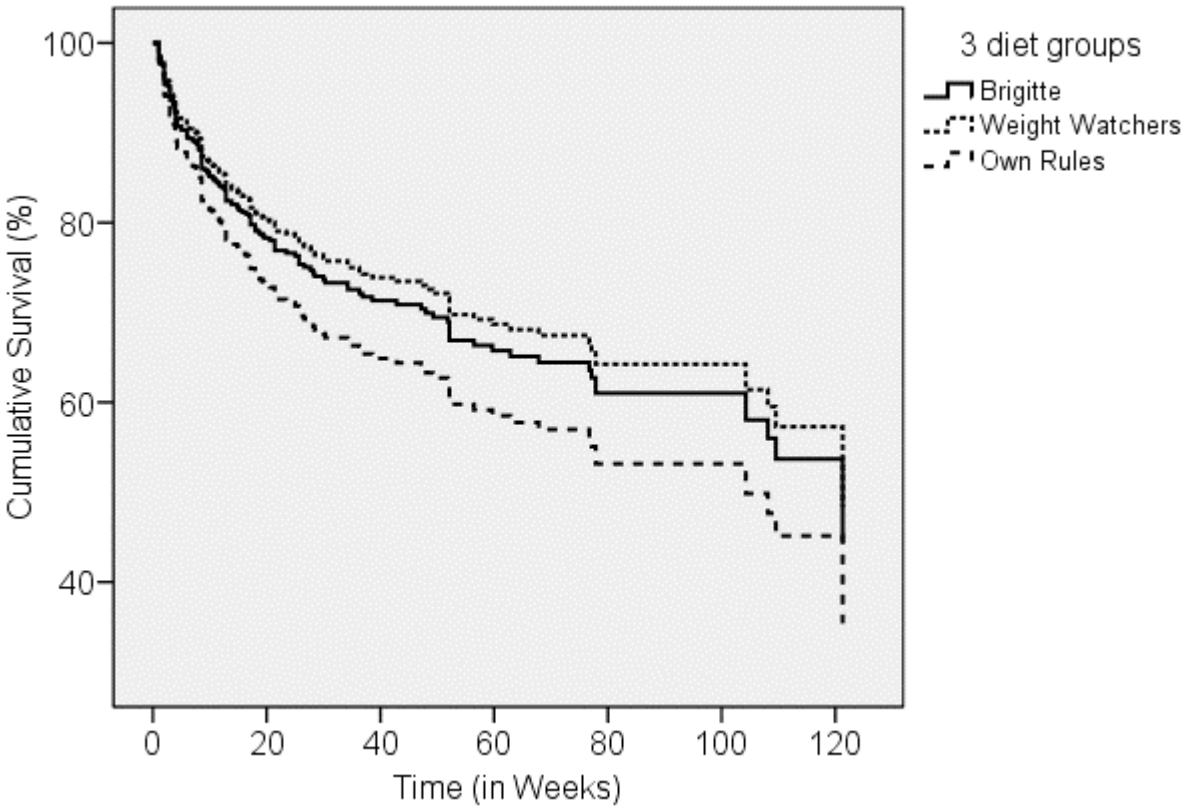


Figure 2. Survival function comparing performance of the three different diet programs.



Manuscript 2

Meat label design:

Effects on stage progression, risk perception, and product evaluation

Mata, J., Lippke, S., Dieckmann, A., & Todd, P. M. (submitted). Meat label design: Effects on stage progression, risk perception, and product evaluation.

Meat label design: Effects on stage progression, risk perception, and product evaluation

Jutta Mata*[1], Sonia Lippke[2], Anja Dieckmann[1, 3], & Peter M. Todd[1, 4]

[1] Center for Adaptive Behavior and Cognition
Max Planck Institute for Human Development
Lentzeallee 94
14195 Berlin, Germany

[2] Department of Health Psychology
Freie Universität Berlin, Germany
Habelschwerdter Allee 45
14195 Berlin, Germany

[3] Gesellschaft für Konsumforschung e.V.
Nordwestring 101
90319 Nürnberg, Germany

[4] Cognitive Science Program
Indiana University
1101 E. 10th Street
Bloomington, IN 47405, USA

* Corresponding author:
jmata@mpib-berlin.mpg.de

Abstract

Scandals regarding animal feed and husbandry are alarming meat consumers, making them worry about possible effects on their health. In two experiments we tested the impact of health-related meat labels on stage of behavior change toward considering food production and ingredients; on risk perception about meat-related illness; and on meat product evaluation, focusing on inter-individual differences in response to label exposure. We also examined how informational content and the context in which labels are assessed influence the evaluation of meat products. In Study 1, more non-intenders moved a stage forward if they were exposed to health-related labels than if they were in the control group. Further, the treatment group reported significantly higher risk perception after the experimental manipulation. In Study 2, informational content and the context of meat label presentation influenced the evaluation of a product, thus leading to a preference reversal effect. Only food labels that provide transparent and evaluable information about a meat product can influence consumers and allow them to make informed and responsible decisions.

Keywords: food label, stages, meat consumption, risk perception, preference reversal, purchasing decisions

Introduction

Meat consumers are worried by food scandals such as meat and bone meal in feed (Pollan, 2004), antibiotics given to cows so they can live on corn instead of grass (Pollan, 2006), and pigs kept in small barns, leading to an easier spread of disease and consequent higher amounts of medication (Berke & Grosse Beilage, 2003). The problems are numerous and make frequent news headlines. Consumers are alarmed (e.g., Köhler & Wildner, 1998)—after all, toxins, growth promoters, and physical treatment of farm animals can eventually affect the health of people (e.g., Nestle, 2003; Walker, Rhubart-Berg, McKenzie, Kelling, & Lawrence, 2005).

Many consumers associate animal-friendly husbandry and feed that is free of additives with positive health (Harper & Makatouni, 2002) and thus want to know where their meat comes from, what the animals were fed, and under what conditions the animals were raised (e.g., Bjørner, Hansen, & Russell, 2004; Imkamp, 2000). Information is an indispensable prerequisite of an individual's health behavior. It is the base of knowledge and personal risk perception, which in turn can lead to behavior change (e.g., Schwarzer, 1992), and it affects food choice in the supermarket (Anderson et al., 1997; Levy, Mathews, Stephenson, Tenney, & Schucker, 1985). However, meat in supermarkets, if packaged at all, is usually sparsely labeled (Bredahl, 2003), displaying no more information than price, weight, and best-used-before date.

Our goal was to study ways to make the conditions under which animals were raised transparent to consumers and to look at how this information affects consumers' perception of a meat product and their purchase intention. We approached this problem from two different theoretical angles: (1) stage models of health behavior, and (2) conjoint versus separate evaluation of information. Specifically, we examined how the health-related information on

meat labels affects people's perceptions about meat and their food choice intentions, and what conditions are needed for this label information to be understandable to the consumer.

Food labels and their effect on people's perceptions and food choices

Becoming aware that food consumption and health are related is the first step toward health-conscious eating behavior. Many consumers pay attention to information about sugar or fat content (Higginson, Rayner, Draper, & Kirk, 2002a) as provided by nutrition labels, but information about such issues as how animals are fed and kept and their effects on health is typically scarce. A recent topic linking animal feed and health that was extensively covered by the media is bovine spongiform encephalopathy (BSE, also known as "mad cow disease"). It is assumed that cows get infected with BSE via meat and bone meal in their feed (e.g., Taylor, Woodgate, & Atkinson, 1995). The human health risk of consuming BSE-tainted meat (i.e., developing a form of Creutzfeldt–Jakob disease) has been widely reported (e.g., Nestle, 2003). Similarly, consumers are developing an increasing awareness of the possible effects of antibiotics in animal feed on their health (e.g., Harper & Makatouni, 2002). Regular antibiotic administration to animals increases the chance that bacteria will develop resistance to the drugs, thus decreasing their effectiveness in treating human illnesses (Walker et al., 2005).

One way to give consumers additional information about meat and thus increase their opportunity to eat in accordance with their values (Hoogland, de Boer, & Boersema, 2005) and intentions is through enhanced labeling on food packages. In contrast to a brand name, food labels explicitly convey information about a product. They are available at the point of purchase, so they can educate the consumer about a product during the process of making a decision (Bettman, Payne, & Staelin, 1987; Higginson, Rayner, Draper, & Kirk, 2002b) and affect whether a product is purchased (Anderson et al., 1997; Bjørner et al., 2004; Levy et al., 1985). Food labels can play an important role in the food marketing system, for example,

through their impact on consumer confidence in food quality or by educating consumers about diet and health (Caswell & Padberg, 1992; Leathwood, Richardson, Straeter, Todd, & van Trijp, in press). All consumers are not alike, however, yet to date, little attention has been paid to identifying which consumers would profit most from additional information (e.g., about a product's characteristics) on food labels. We next consider whether individual motivation can interact with the effect of food labels.

Differential effects of food labels on behavior

It has been shown that people with stronger environmental values pay more attention to environmental labels (Hoogland, et al., 2005; Lockie, Lyons, Lawrence, & Grice, 2004). Consumers with a specific nutrition goal or health concern (e.g., losing weight) look more often at nutrition labels or health claims (Higginson et al., 2002b). These findings suggest that food labels can be tailored to meet specific concerns of consumers. We wanted to go one step further and test whether label information has different effects on people who are already motivated to change their food choice behavior versus consumers who have not yet considered changing.

Behavior change has often been described in terms of individuals moving across qualitatively different *stages of change* (Prochaska & DiClemente, 1983; Sutton, 2005; Weinstein, Rothman, & Sutton, 1998). At least three different stages can be differentiated according to the Health Action Process Approach (HAPA; Schwarzer, 1992; Lippke, Ziegelmann, & Schwarzer, 2005): the non-intentional stage, the intentional stage, and the action stage. The variables that lead to stage progression are different for the distinct stages of behavior change. In the *non-intentional stage*, as the name suggests, individuals have no intention to change their behavior. If their risk perception increases, they can progress to the next stage. In the *intentional stage*, the individual intends to adopt a new behavior but is not performing it yet. At this stage, information on risk or benefit of a behavior no longer affects

the likelihood of carrying out the new behavior. Instead, instruction on *how* to integrate the new behavior into daily life is influential. Here, planning how to get started facilitates the behavior change, and how to deal with barriers plays a key role (Lippke, Ziegelmann, & Schwarzer, 2004). For people who progress to the *action stage* the focus is on adopting and maintaining the behavior. Overall, interventions can be tailored more effectively if they are matched to the stage a person is in (Bridle et al., 2005; Weinstein et al., 1998). Some critics of stage models have questioned the existence of stages or whether stages are not just arbitrary divisions of an underlying continuum (Sutton, 2005; Weinstein et al., 1998). A stage model may be said to exist if different variables show a discontinuous pattern across stages (Armitage & Arden, 2002; Sutton, 2005). Individuals at a particular stage should have qualitatively different characteristics from individuals at other stages (Weinstein et al., 1998). In the context of meat labels, health-related information on the labels can lead to a change in subjective risk or benefit perceptions of non-intenders, which could be the first step toward intending to buy healthier products (Lippke et al., 2005; Renner & Schwarzer, 2005). Health-related information should not affect intentions of people who already consume or intend to consume healthier meat products, that is, intenders and actors (Lippke et al., 2005; Weinstein et al., 1998). Intenders could only progress in stage of behavior change by acting, for example purchasing a labeled product; actors could increase their buying frequency. Meat labels could be decision aids for intenders and actors allowing them to make meat choice in accordance with their preferences. By controlling for people's stages in relation to health behavior, we will investigate interindividual differences in responses to meat labels.

Information environment and the preference reversal effect

To make an informed purchasing decision based on a food label, the information on the label has to be evaluable to the consumer. There is extensive evidence from both basic and applied psychological research that the same information presented in different modes or

formats can result in dissimilar evaluations of a product (for reviews, see Bettman, 1979; Hsee, 1996; Johnson & Busemeyer, 2005; Payne, 1982; Winett & Kagel, 1984; Seidl, 2001). Two widely studied presentation modes are separate and conjoint presentation. *Separate presentation* means a product or a product attribute is evaluated by itself, whereas in *conjoint presentation* mode, a product or product attribute is assessed at the same time as another product, providing a comparison standard. Evaluating a product in these two different modes can result in a so-called *preference reversal effect* (Hsee, 1996)): Product A is preferred over Product B if both products are evaluated separately, while seeing both products simultaneously in a conjoint evaluation mode leads to the reverse, a preference for Product B over Product A.

This effect usually occurs when one of the product attributes is difficult to judge by itself, and another attribute can be easily evaluated alone. For example, Hsee (1996) showed his participants two dictionaries: One had a damaged cover (easy to evaluate by itself) and 20,000 entries (difficult to evaluate without comparison). The other one had an intact cover but only 10,000 entries. When the two were presented separately, participants were willing to pay more for the intact cover dictionary. However, when the books were presented in conjoint mode, the dictionary with more entries was judged to be more valuable. Can a similar effect be found for food labels? Specifically, does the evaluation of a meat label depend on information about other available products as provided in conjoint presentations?

Hypotheses

The aim of these studies was to investigate how health-related information on food labels affects people's risk perception and consequently their intentions to purchase meat. Furthermore, we wanted to test how this information on labels can be designed to be understandable and thus used by the consumer. Based on the literature reviewed above we propose the following: (1) Reading of health-related information on food labels leads to

increased risk perception in non-intenders and thus promotes stage progress. These effects do not occur in intenders and actors. (2) How label information is evaluated depends on the presentation mode. If the same food label is shown in different information contexts, that is, in separate or conjoint mode, a preference reversal effect occurs. The first hypothesis is tested in Study 1, while Study 2 addresses the second hypothesis. Both studies were approved by the ethics committee of the Max Planck Institute for Human Development, Berlin, Germany.

Study 1

Participants

Sixty-nine participants were recruited from the pool of experimental subjects at the Max Planck Institute for Human Development. Thirty-four participants were randomly assigned to the treatment group and 35 to the control group. Participants were on average 26 years old (range: 20–33 years). Fifty-five percent were women. None of the participants were vegetarian; they bought on average two pork cutlets (our experimental stimulus—see below) per month in a supermarket.

Procedure

Participants came to the laboratory where they first signed the informed consent form. All questions and experimental stimuli were presented on a computer screen (Czienskowski, 2006). They received instructions on the computer screen and if they did not have clarification questions started the experiment. The study took between 10 and 20 min to complete. At the end, participants received 2 euros as reimbursement.

Experimental Design

First, stage of behavior change toward considering ingredients and method of food production was assessed for all participants (see measure descriptions, below). Next, participants in the treatment group were exposed to health-related food labels. In particular,

they compared pairs of pork cutlets that partly had health-related information on their labels, deciding for every pair which cutlet they would rather buy. The treatment consisted of a series of 18 choice tasks. In each task, pairs of cutlets were presented conjointly on a computer screen. The information on the label varied in three different aspects: whether it identified the pork cutlet as "organic," had additional detailed information on organic attributes according to the regulations of the European Union (2003) for organically and conventionally raised pigs (i.e., ecological origin of animal's feed, animal friendly husbandry, and the absence of hormones or medication in the raising of the animals), and price. Thus, the participants' task was similar to deciding between two meat products in the supermarket by comparing the information on the two products. Figure 1 shows one of the screens the treatment group saw. Then they were shown one more screen with a label displaying expiration date, weight and barn area per animal. Participants in the control group only evaluated this one cutlet without being exposed to the health-related information the intervention group had seen. After this evaluation, participants in both groups again stated their stage of behavior change toward considering ingredients and method of food production. Based on our hypotheses we were primarily interested in stage progression in non-intenders, especially since intenders and actors would have to perform the behavior, that is, actually purchase a labeled pork cutlet in order to change their stage, which was not possible in the time frame of this experiment.

Measures. Stage of behavior change was assessed before and after the experiment with the same question: "Please think about your nutrition: Do you pay attention to ingredients or the method of production of food?" The five answer anchors were "No, and I do not intend to," "No, but I am considering it," "No, but I seriously intend to start," "Yes, but only for a brief period of time," and "Yes, and for a long period of time" (Lippke, Ziegelmann, Schwarzer & Velicer, 2007; adapted to the context of purchasing food).

Risk perception was calculated as a product of perceived vulnerability to and severity of different illnesses, specified as follows. Vulnerability was measured with four statements

starting with "If I keep my lifestyle as it is right now, the probability is high that I will get…" followed by "a disease that is due to additives in feed or medication given to animals (e.g., hormones or antibiotics); high blood pressure; a stroke; and a heart attack." Each of these statements was rated on a 4-point scale from "not at all true" to "exactly true." Severity was measured by asking "How detrimental to your health are the following health problems if they are not diagnosed or treated?" The four health problems were identical to those in the vulnerability statement. Answer options ranged from "not detrimental at all" to "very detrimental" on a 4-point scale (Schwarzer et al., 2007—adapted).

Results

Stage movements

Stage of health behavior change toward paying attention to ingredients and method of production when purchasing food did not differ between treatment and control groups prior to the experimental manipulation ($\chi^2 = 0.01$, $p = .99$). After the manipulation, 15% of participants in the treatment group had progressed at least one stage forward, 82% did not change their stage, and 3% regressed at least one stage backward. In the control group, 6% progressed, 86% did not change, and 9% regressed. This difference in stage movement is not significant ($\chi^2 = 2.34$, $p = .31$).

However, following our hypothesis, we were more interested in the effect of meat labels on non-intenders. In the control group, none of the non-intenders progressed in stage. In the treatment group, around half of the non-intenders (4 out of 9 people – see Table 1) moved forward in stage. We tested whether stage allocation of the treatment group differed significantly before and after the intervention. To do so, we used the Freeman–Halton Test (Freeman & Halton, 1951) for $k \times 2$ tables with small frequencies, where k is the number of groups to be compared, because cell numbers were too small for a chi-square test. The stage allocation of the non-intenders in the treatment group before exposure to health-related labels

differed significantly from the stage allocation afterward (p = .04, Freeman–Halton Test). Since there was no stage movement in the control group, we can say that in summary, non-intenders of the treatment group progressed in stage; non-intenders of the control group did not.

Risk perception

After the experimental manipulation, the treatment group had a higher risk perception of *diseases due to additives in feed or medication given to animals* (e.g., hormones or antibiotics), $M_{treatment}$ = 6.76, $SD_{treatment}$ = 2.86; $M_{control}$ = 5.23, $SD_{control}$ = 1.85; $t(67) = 2.66$, p = .01; Cohen's d = 0.64. Differentiated into the stages, non-intenders in the treatment group also had a higher risk perception than non-intenders in the control group. However, despite a medium-to-large effect size, this effect is not significant, due to the small sample size, $M_{treatment}$ = 7.33, $SD_{treatment}$ = 3.71; $M_{control}$ = 5.67, $SD_{control}$ = 2.00; $t(16) = 1.19$, p = .25; Cohen's d = 0.56.

The treatment group, however, did not differ from the control group in risk perception *unrelated to meat products*, that is, regarding high blood pressure (Cohen's d = 0.22), stroke (Cohen's d = 0.22), or heart disease (Cohen's d = 0.17). Again, when differentiated into stages, non-intenders in the treatment group did not differ from non-intenders in the control group regarding blood pressure (Cohen's d = 0.29), stroke (Cohen's d = −0.04), or heart disease (Cohen's d = −0.06). Furthermore, the effect sizes were smaller than for the meat-related risk perception. These findings suggest that exposure to health-related meat labels specifically affected risk perceptions of meat-related illnesses, and not risk perceptions in general.

Discussion

We investigated the influence of meat label information on risk perception and stages of health behavior change. As hypothesized, a significant proportion of people without

previous intention to consider animal husbandry in their food decisions progressed to a later health behavior change stage after exposure to information-rich meat labels. We showed that meat labels are especially effective for consumers who had not previously considered paying attention to ingredients and method of production. These non-intenders in the treatment group (i.e., those who saw additional information on animal keeping and feeding on the meat labels) more often moved a stage forward than non-intenders in the control group. This result suggests that labels can be an effective treatment for non-intenders because they provide the necessary information in an adequate way that promotes stage of behavior change.

The health-related information was presented in an indirect way, stating information on animal feed and husbandry but not explicitly warning about possible consequences for human health. So why do a substantial portion of the non-intenders care and not ignore the information? There are at least three possible explanations of how this type of meat label affected non-intenders: First, Bushman (1998) showed that information labels are as effective as or more effective than warning labels for changing consumer intentions. He suggests that warning labels can lead to reactance, thus making it more likely that information is ignored, whereas people do not seem to mind receiving information about a product and thus are more likely to consider it for their behavior. Second, the non-intenders might have generalized the positive product information on feeding and husbandry to other product attributes, such as healthfulness ("halo effect", cf. Roe, Levy, & Derby, 1999). In contrast, the non-organic meat currently available in supermarkets might appear unhealthful, leading non-intenders to reconsider their usual choices. Last, research on human decision strategies shows that in order to decide which product is better, people often simply tally the amount of positive information, without weighting the information by its importance (as in the majority rule or in "Dawes's Rule"; see, e.g., Dawes, 1979; Rieskamp & Hoffrage, 1999). As a result, the product with a higher number of positive cues is evaluated as better. Since the labels used in our study display additional positive information in comparison to conventional labels, they might have

been perceived as the better option and thus lead non-intenders to decide to buy meat products with animal friendly husbandry and feed free of hormones or antibiotics in the future.

As we expected, labels did not affect stage of behavior change of participants in the intention or action stage. These findings are in accordance with previous research showing that stage-matched interventions can be more effective than non-matched interventions (Bridle et al., 2005; Lippke et al., 2004; Weinstein, Lyon, Sandman, & Cuite, 1998).

Risk perception concerning diseases due to additives in feed and medication given to animals was higher in those participants who saw the labels with additional information, but looking at labels did not have an impact on perceptions of general health-related risks. This finding suggests that labels tailored to a certain audience (here, consumers who had not intended to pay attention to ingredients and method of production) could be an effective tool for altering intentions—specifically toward the purchase of the labeled product—which is the first step to behavior change (Lippke et al., 2005; Renner & Schwarzer, 2005).

One aspect that has not been addressed in this research is how label design influences whether people understand the presented information well enough for it to affect their intentions. This question is particularly important when new, possibly unfamiliar information is added to a label, as in the case of barn area per animal on meat labels. As already described in the Introduction, barn area is important health information because barns that are too small lead to a faster spread of disease and thus more frequent medication of animals. We wanted to test whether people can use information about pen size on its own or only when compared with a comparison standard, for example, on other labels, in Study 2.

Study 2

Participants

As in Study 1, the pool of experimental subjects at the Max Planck Institute for Human Development provided 90 participants. Participants were on average 24 years old

(range: 18–34 years). Forty-nine percent were women. None of the participants were vegetarian; they bought on average 2.2 cutlets per month in a supermarket.

Procedure

Participants came to the laboratory where they first signed the informed consent form. They were randomly assigned to one of nine conditions. All questions and stimuli were presented in a questionnaire. The study took about 3 min to complete, and at the end participants were reimbursed with € 0.50 for their participation. Afterward they participated in another study unrelated to this research that was running at the laboratory at the time.

Experimental Design

This study was a between-subjects design with nine conditions. Conditions varied in two aspects: the content of the meat label, and the presentation mode (separate evaluation vs. conjoint evaluation). There were five different labels: The target label (1.3m^2 barn area per pig, no additional attributes) and four different labels (all 0.65 m^2 barn area per pig and one of four additional attributes). All labels were evaluated in separate presentation mode, resulting in five conditions. Additionally, in conjoint presentation mode, the target label was compared to each of the other four label (as shown in Figure 2), resulting in another four conditions. Barn area was used as a non-evaluable cue (difficult to interpret without a comparison standard), while the additional attributes presented on the other four labels, were chosen to be individually evaluable: “from the region,” “with freshness guarantee,” “tender and lean,” and “German quality meat.” To make the task as ecologically valid as possible, the additional attributes on the labels were selected from an environmental analysis in five different supermarkets: two discounters, two middle-scale supermarkets, and one upscale grocery section of a large department store. We analyzed all pork cutlet products in these stores for what additional attributes (beyond price and weight) were described on the package. From these collected attributes we selected the four mentioned above because they added further

positive value to the cutlet and did not interfere with the independent variable barn area (as "controlled upbringing" would have done) or the dependent variable, willingness to pay (as would have "on sale").

To test whether a preference reversal effect occurs in the food label context with two label attributes, cutlets were displayed in separate or conjoint presentation mode. Each screen was evaluated by 10 participants, adding up to 90 participants total. Each participant saw only one of the conditions and was asked how much he or she would pay for the cutlet(s) presented. Participants were additionally asked for their age, gender, and how often they bought pork cutlets per month. The data of two participants in the separate evaluation and one in the conjoint evaluation condition were excluded because they answered they wanted to pay €0.00 for the cutlet or both cutlets, respectively.

Results

To calculate whether the difference in evaluation of the two options was significantly different in the conjoint versus the separate presentation mode, and if a preference reversal effect had occurred, we used the formula suggested by Hsee (1996, p. 248)[1]. Figure 3 shows the overall results of Study 2. In the condition with "tender and lean" on the label, there was a significant preference reversal effect between separate and conjoint evaluation, $t(27) = 3.28$; $p = .002$. When the options were evaluated separately, the label with the smaller barn area but the additional positive attribute was evaluated higher (in terms of willingness to pay) than the cutlet's label with a bigger barn area, $M_{small} = 2.3$, $SD_{small} = 1.0$; $M_{big} = 1.52$, $SD_{big} = 0.56$; $t(18) = -2.15$, $p = .05$; Cohen's $d = 0.96$, whereas the opposite was found when the two options were evaluated conjointly, $M_{small} = 1.85$, $SD_{small} = 1.29$; $M_{big} = 2.87$, $SD_{big} = 1.8$; $t(9) = 3.78$, $p < .01$; Cohen's $d = 0.65$.

The same evaluation pattern was found for the additional attribute "from the region" on the label: A preference reversal effect occurred between the two evaluation modes, $t(25) =$

3.70, $p = .001$. In the separate evaluation mode, participants were willing to pay more for the cutlet describing the smaller barn area and being from the region than for the one with the larger barn area; however, despite a large effect, this difference is not significant, $M_{small} = 2.2$, $SD_{small} = 1.22$; $M_{big} = 1.52$, $SD_{big} = 0.56$; $t(11) = -1.45$, $p = .17$; Cohen's $d = 0.72$. In the conjoint evaluation, the cutlet label describing the bigger barn area was evaluated to be worth more, and the difference is significant on a $p < .10$ level, $M_{small} = 1.91$, $SD_{small} = 0.68$; $M_{big} = 2.32$, $SD_{big} = 0.94$; $t(8) = 1.95$, $p = .09$; Cohen's $d = 0.50$.

There was no significant preference reversal effect for the label with the additional attribute "freshness guarantee," $t(26) = 1.15$, $p = .26$, which is reflected in the finding that there was almost no difference between the cutlet labels in the separate evaluation mode, $M_{small} = 1.48$, $SD_{small} = 0.66$; $M_{big} = 1.52$, $SD_{big} = 0.56$; $t(17) = 0.16$, $p = .88$; Cohen's $d = 0.07$. This suggests that the freshness guarantee was not as attractive an attribute as those above. In the conjoint evaluation, however, participants again were willing to pay significantly more for the cutlet with the large barn area, $M_{small} = 2.47$, $SD_{small} = 1.14$; $M_{big} = 3.11$, $SD_{big} = 1.64$; $t(9) = 2.45$, $p = .04$; Cohen's $d = 0.45$. Finally, despite small differences in the appropriate direction, a significant preference reversal effect did not occur when "German quality meat" was added to the label with the smaller barn area, $t(27) = 1.37$, $p = .18$. Willingness to pay was not significantly different between the options when evaluated separately, $M_{small} = 1.87$, $SD_{small} = 0.83$; $M_{big} = 1.52$, $SD_{big} = 0.56$; $t(18) = -1.11$, $p = .28$; Cohen's $d = 0.49$, or conjointly, $M_{small} = 2.15$, $SD_{small} = 0.88$; $M_{big} = 2.32$, $SD_{big} = 0.55$; $t(9) = 1.20$, $p = .26$; Cohen's $d = 0.23$.

Discussion

We showed that whether additional information on animal keeping is transparent to the consumer, and therefore can be taken into account when evaluating the product, depends on the context in which it is presented. This was illustrated by the occurrence of a preference

reversal in multiple situations. Separate versus conjoint presentation mode influenced whether participants could integrate additional descriptions on animal keeping into their evaluation of a product. In particular, the presence of preference reversal for cutlets with labels containing information about pen size indicates that this attribute is difficult for people to evaluate on its own. This result suggests that transparency of information can be increased by providing a comparison standard to facilitate consumers' evaluation of product attributes, such as providing a comparative scale for an attribute on each label or an in-store list of all comparable products and their characteristics (Bettman et al., 1987). Overall, participants did not take barn area into account when labels were presented separately; they did, however, in the conjoint evaluation. Participants even preferred the cutlet from pigs raised in a smaller barn area in the separate evaluation condition, when "from the region" and "tender and lean" were added to labels, indicating that both of these characteristics add additional value to the product.

These findings tell us two further things: First, "from the region" and "tender and lean" seem to be perceived as important decision factors, in accordance with the findings of Savell et al. (1989), who reported that leanness was one of the predominant selection criteria for beef. At the same time, when our participants had a comparison standard in the conjoint evaluation mode the size of barn area in which pigs were raised was seen as more important. Second, the fact that consumers were willing to pay more for the cutlet with the larger barn area—when presented conjointly—than for a cutlet "from the region" (which can be interpreted as an ethical/environment-related attribute because it implies that the transport of the animals or the meat was not long distance and thus put less stress on the animal during transport or polluted the environment less), or a cutlet labeled "tender and lean" (which is more of a health-related attribute—lean implies less fat, which in turn can be perceived as more healthy) suggests that barn area could be perceived as both an ethical/environmental issue and a health issue (e.g., larger barn area can also imply less stress, better feed, or less

medication). This might be a reason why people were willing to pay more for larger barn area (cf. results that consumers were willing to pay more for organic labels by Teisl, Roe, & Hicks, 2002; Roe, Teisl, Levy, & Russell, 2001).

General Discussion and Conclusion

These two experiments extend previous literature on the effect of food labels on consumer intentions and on presentation of food label information by showing that meat labels are an especially effective tool for those consumers who did not have previous intentions about a behavior. Furthermore, the information context in which a label is presented influences how easily information can be evaluated and thus determines whether people can use it. This work has a number of limitations: First, we measured food choice intentions and willingness to pay, which, though they are important predictors of behavior, are just proximal measures of actual purchasing behavior. Second, the number of non-intenders studied in the first experiment was rather small. However, the fact that stage progression occurred in the non-intenders of the treatment group emphasizes the effectiveness of the meat label intervention. Finally, our participants can be described as occasional pork meat consumers. Given the rather small sample size and the eating habits of our sample the results should be generalized cautiously. Nonetheless, food labels could be a promising means to make the production chain of meat more transparent and to educate consumers about products. This is especially the case if consumers did not previously have intentions to consider certain aspects, such as production mode, of a food product. When presenting additional information it seems to be important to consider the information context in which it is presented; it could be profitable to add a comparison standard to the label by which a new attribute can be assessed. This research not only is valuable in the context of animal husbandry and its consequences for human health but likely has further application to other

health-related labels, such as health claims (Leathwood et al., in press; Wansink, Sonka, & Hasler, 2004).

References

Anderson, E. S., Winett, R. A., Bickley, P. G., Walberg-Rankin, J., Moore, J. F., Leahy, M., Harris, C. E., & Gerkin, R. E. (1997). The effects of a multimedia system in supermarkets to alter shoppers' food purchases. *Journal of Health Psychology, 2*, 209-223.

Armitage C. J., & Arden M. A. (2002). Exploring discontinuity patterns in the transtheoretical model: An application of the theory of planned behaviour. *British Journal of Health Psychology, 7*(1), 89-103.

Berke, O., & Grosse Beilage, E. (2003). Spatial relative risk mapping of pseudorabies-seropositive pig herds in an animal-dense region. *Journal of Veterinary Medicine, Series B, 50,* 322–325.

Bettman, J. R. (1979). An information processing theory of consumer choice. Reading, MA: Addison-Wesley.

Bettman, J. R., Payne, J. W., & Staelin, R. (1987). Cognitive considerations in designing effective labels for presenting risk information. In K. Viscusi & W. Magat (Eds.), *Learning about risk: Evidence on the economic responses to risk information* (pp. 1-28). Cambridge, MA: Harvard University Press.

Bjørner, , T. B., Hansen, L. G., & Russell, C. S. (2004). Environmental labeling and consumers' choice—an empirical analysis of the effect of the Nordic Swan. *Journal of Environmental Economics and Management, 47*, 411-434.

Bredahl, L. (2003). Cue utilization and quality perception with regard to branded beef. *Food Quality and Preference, 15*, 65-75.

Bridle, C., Riemsma, R. P., Pattenden, J., Sowden, A. J., Mather, L., Watt, I. S., et al. (2005). Systematic review of the effectiveness of health behavior interventions based on the transtheoretical model. *Psychology & Health, 20*, 283-301.

Bushman, B. J. (1998).Effects of warning and information labels on consumption of full-fat, reduced-fat, and no-fat products. *Journal of Applied Psychology, 83*, 97-101.

Caswell, J. A., & Padberg, D. I. (1992). Toward a more comprehensive theory of food labels. *American Journal of Agricultural Economics, 74*, 460-468.

Czienskowski, U. (2006). Food choice experiment. [computer software]. Berlin, Germany: Max Planck Institute for Human Development.

Dawes, R. M. (1979). The robust beauty of improper linear models in decision making. *American Psychologist, 34,* 571-582.

Freeman, G. H., & Halton, J. H. (1951). Note on an exact treatment of contingency goodness of fit and other problems of significance. *Biometrika, 38*, 141-149.

Harper, G. C., & Makatouni, A. (2002). Consumer perception of organic food production and farm animal welfare. *British Food Journal, 104*(3–5), 287-299.

Higginson, C. S., Rayner, M. J., Draper, S., & Kirk, T. R. (2002a). The nutrition label—which information is looked at? *Nutrition and Food Science, 32*(3), 92-99.

Higginson, C. S., Rayner, M. J., Draper, S., & Kirk, T. R. (2002b). How do consumers use nutrition label information? *Nutrition & Food Science, 32*(4), 145-152.

Hoogland, C. T., De Boer, J., & Boersema, J. J. (2005). Transparency in the meat chain in the light of food culture and history. *Appetite, 45*, 15-23.

Hsee, C. K. (1996). The evaluability hypothesis: An explanation for preference reversals between joint and separate evaluations of alternatives. *Organizational Behavior and Human Decision Processes, 67*(3), 247-257.

Imkamp, H. (2000). The interest of consumers in ecological product information is growing—evidence from two German surveys. *Journal of Consumer Policy, 23*, 193-202.

Johnson, J. G., & Busemeyer, J. R. (2005). A dynamic, stochastic, computational model of preference reversal phenomena. *Psychological Review, 112*, 841-861.

Köhler, F., & Wildner, S. (1998). *Consumer concerns about animal welfare and the impact on food choice. A review of the German literature.* Review Report. University of Kiel, Germany. EU-Project CT98 3678.

Leathwood, P. D., Richardson, D. P., Straeter, P., Todd, P. M., & Trijp, H. C. M. van. (in press). Consumer understanding of nutrition and health claims: Sources of evidence. *British Journal of Nutrition*.

Levy, A., Mathews, O., Stephenson, M., Tenney, J., & Schucker, R. (1985). The impact of a nutrition information program on food purchases. *Journal of Public Policy and Marketing, 4*(1), 1-13.

Lippke, S., Ziegelmann, J. P., & Schwarzer, R. (2004). Initiation and maintenance of physical exercise: Stage-specific effects of a planning intervention. *Research in Sports Medicine, 12*, 221-240.

Lippke, S., Ziegelmann, J. P., & Schwarzer, R. (2005). Stage-specific adoption and maintenance of physical activity: Testing a three-stage model. *Psychology of Sport and Exercise, 6*, 585-603.

Lippke, S., Ziegelmann, J. P., Schwarzer, R., & Velicer, W. F. (2007). *Validity of stage assessment in the adoption and maintenance of physical activity and fruit and vegetable consumption*. Manuscript submitted for publication.

Lockie, S., Lyons, K., Lawrence, G., & Grice, J. (2004). Choosing organics: A path analysis of factors underlying the selection of organic food among Australian consumers. *Appetite, 43*, 135-146.

Nestle, M. (2003). *Safe food. Bacteria, biotechnology and bioterrorism.* Berkeley, CA: University of California Press.

Payne, J. W. (1982). Contingent decision behavior. *Psychological Bulletin, 92*, 382-402.

Pollan, M. (2004, January 11). The way we live now: 01-11-04; Cattle futures? *The New York Times*.

Pollan, M. (2006). *The omnivore's dilemma*. New York: Penguin Press.

Prochaska, J. O., & DiClemente, C. C. (1983). Stages and processes of self-change of smoking: Toward an integrative model of change. *Journal of Consulting and Clinical Psychology, 51*(3), 390-395.

Renner, B., & Schwarzer, R. (2005). The motivation to eat a healthy diet: How intenders and nonintenders differ in terms of risk perception, outcome expectancies, self-efficacy, and nutrition behaviour. *Polish Psychological Bulletin, 36*(1), 7-15.

Rieskamp, J., & Hoffrage, U. (1999). When do people use simple heuristics and how can we tell? In: G. Gigerenzer, P. Todd, & The ABC Research Group. *Simple heuristics that make us smart* (p.141-167). New York: Oxford University Press.

Roe, B.E., Levy, A.S. and Derby, B.M. (1999). The impact of health claims on consumer search and product evaluation outcomes: results from FDA experimental data. *Journal of Public Policy and Marketing 18*(1), 89-115.

Roe, B., Teisl, M. F., Levy, A., & Russell, M. (2001). Consumer preferences for residential electricity services with different generation sources and air emission profiles. *Energy Policy, 29,* 917-925.

Savell, J. W., Cross, H. R., Francis, J. J., Wise, J. W., Hale, D. S., Wilkes, D. L., & Smith, G. C. (1989). National consumer retail beef study: Interaction of trim level, price and grade on consumer acceptance of beef steaks and roasts. *Journal of Food Quality, 12*, 251-274.

Schwarzer, R. (1992). Self-efficacy in the adoption and maintenance of health behaviors: Theoretical approaches and a new model. In R. Schwarzer (Ed.), *Self-efficacy: Thought control of action* (pp. 217–243). Washington, DC: Hemisphere.

Schwarzer, R., Schüz, B., Ziegelmann, J. P., Lippke, S., Luszczynska, A., & Scholz, U. (2007). Adoption and maintenance of four health behaviors: Theory-guided longitudinal

studies on dental flossing, seat belt use, dietary behavior, and physical activity. *Annals of Behavioral Medicine, 33*(2), 156-166.

Seidl, C. (2001). Preference reversal. *Journal of Economic Surveys, 16,* 621-655.

Sutton, S. (2005). Stage theories of health behaviour. In M. Conner & P. Norman (Eds.), *Predicting health behaviour: Research and practice with social cognition models* (2nd ed., pp. 223-275). Buckingham, UK: Open University Press.

Taylor, D. M., Woodgate, S. L., & Atkinson, M. L. (1995). Inactivation of the bovine spongiform encephalopathy agent by rendering procedures. *The Veterinary Record, 137*, 605-610.

Teisl, M. F., Roe, B. & Hicks, R. (2002). Can Eco-Labels Tune a Market? Evidence from Dolphin-Safe Labeling of Canned Tuna. *Journal of Environmental Economics and Management, 43,* 339-59.

Walker, P., Rhubart-Berg, P., McKenzie, S., Kelling, K., & Lawrence, R. S. (2005). Public health implications of meat production and consumption. *Public Health Nutrition, 8*(4), 348-356.

Wansink, B., Sonka, S. T., & Hasler, C. M. (2004). Front-label health claims: When less is more. *Food Policy, 29*(6), 659-667.

Weinstein, N. D., Lyon, J. E., Sandman, P. M., & Cuite, C. L. (1998). Experimental evidence for stages of health behavior change: The precaution adoption process model applied to home radon testing. *Health Psychology, 17*(5), 445-453.

Weinstein, N. D., Rothman, A. J., & Sutton, S. R. (1998). Stage theories of health behavior: Conceptual and methodological issues. *Health Psychology, 17*(3), 290-299.

Winett, R. A., & Kagel, J. H. (1984). Effects of information presentation format on resource use in field settings. *Journal of Consumer Research, 11*, 655-667.

Footnote

[1] $t = [(M_{J1}-M_{J2})-(M_{S1}-M_{S2})]/[(S_J^2/N_J+S_1^2/N_1+S_2^2/N_2)]^{1/2}$; where M_{J1}, M_{J2}, M_{S1}, and M_{S2} are the means for Options 1 and 2 in conjoint ($_J$) and separate ($_S$) evaluation, S_J^2, S_1^2, and S_2^2 are the respective variances, and N is the number of participants per condition. Note that the separate evaluation is between subjects, the conjoint evaluation within subjects.

Table 1

Stage movement of treatment and control groups before and after the experimental manipulation

After treatment					
		Stage regression	Stage continuance	Stage progression	Total
Treatment group	Non-intenders	–	5	4	9 (26%)
	Intenders	1	2	1	4 (12%)
	Actors	0	21	-	21 (62%)
	Total	1 (3%)	28 (82%)	5 (15%)	
Control group	Non-intenders	-	9	0	9 (26%)
	Intenders	1	1	2	4 (12%)
	Actors	2	20	–	22 (62%)
	Total	3 (9%)	30 (86%)	2 (6%)	

Figure Captions

Figure 1

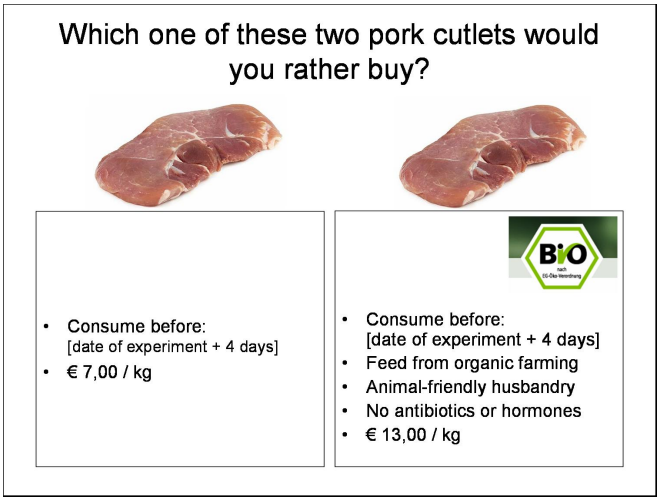
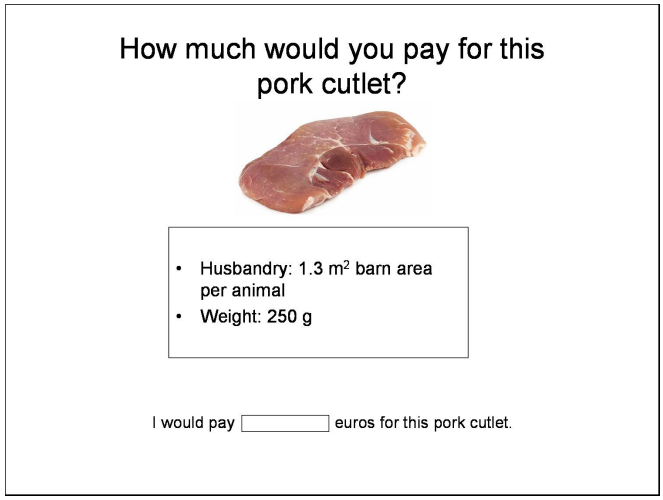
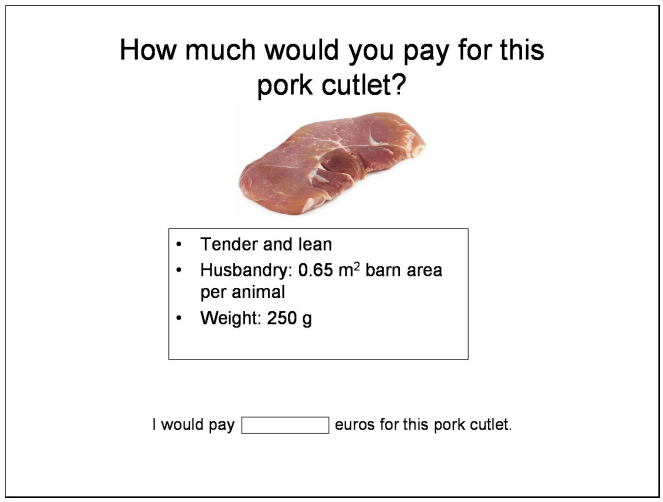

Which one of these two pork cutlets would you rather buy?
• Consume before: [date of experiment + 4 days]
• € 7,00 / kg
BIO
• Consume before: [date of experiment + 4 days]
• Feed from organic farming
• Animal-friendly husbandry
• No antibiotics or hormones
• € 13,00 / kg

Figure 2

Separate evaluation A



Separate evaluation B



Conjoint evaluation

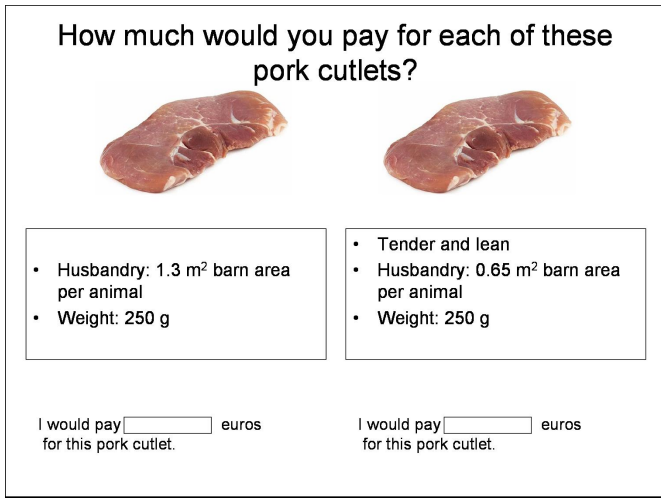
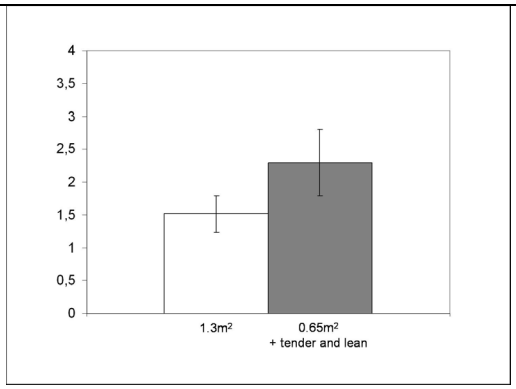
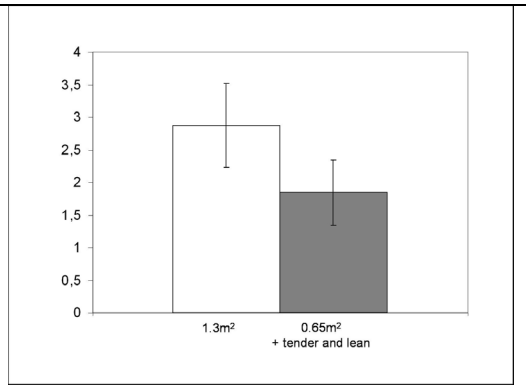
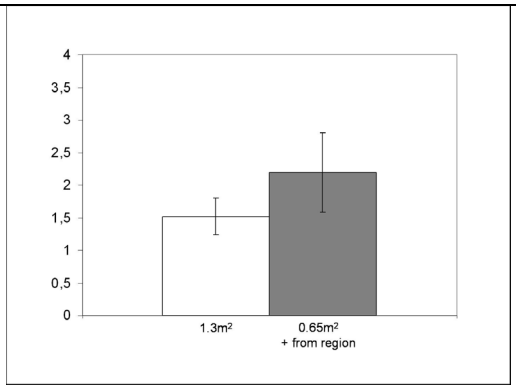
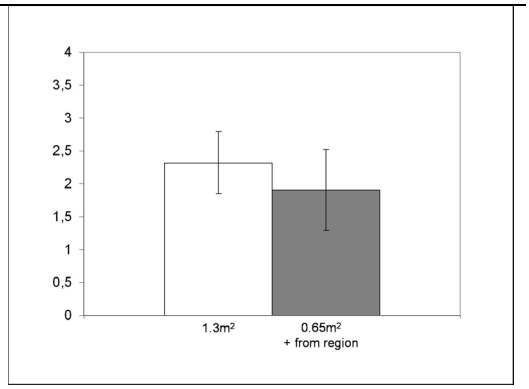
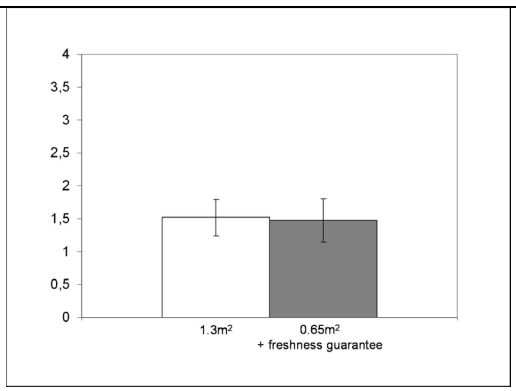
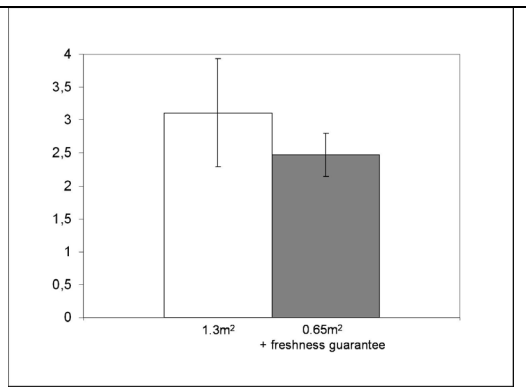
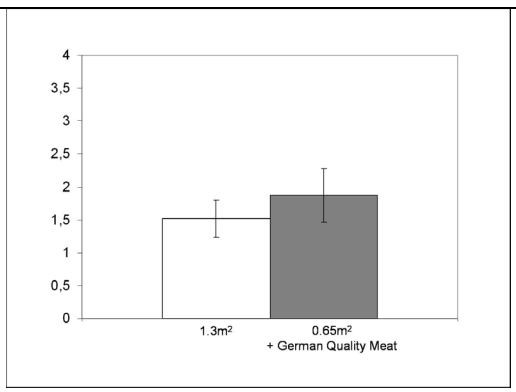
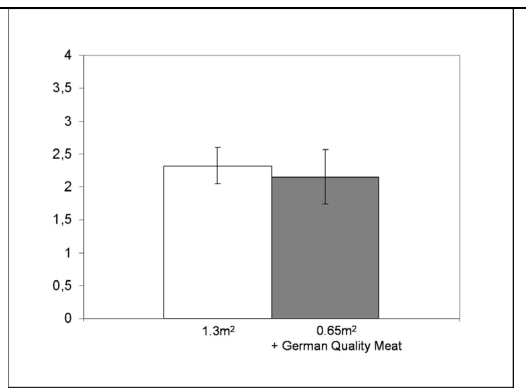


Figure 3

	Separate evaluation	Conjoint evaluation
Tender and lean		
From the region		
Freshness guarantee		
German quality meat		

Manuscript 3

Predicting children's meal preferences: How much do parents know?

Mata, J., Scheibehenne, B., & Todd, P. M. (in press). Predicting children's meal preferences: How much do parents know? *Appetite.*

Predicting children's meal preferences: How much do parents know?

Jutta Mata [1,2], Benjamin Scheibehenne [1], Peter M. Todd [1, 3]

[1] Center for Adaptive Behavior and Cognition
Max Planck Institute for Human Development
Lentzeallee 94
14195 Berlin, Germany
jmata@mpib-berlin.mpg.de
scheibehenne@mpib-berlin.mpg.de

[2] Department of Health Psychology
Freie Universität Berlin, Germany
Habelschwerdter Allee 45
14195 Berlin, Germany

[3] Cognitive Science Program
Indiana University, Bloomington
1101 E. 10th Street
Bloomington, IN 47405, USA
pmtodd@indiana.edu

Corresponding author:
jmata@mpib-berlin.mpg.de (Jutta Mata)

Not for publication:
Phone: ++49 – 30- 82406-698
Fax: ++49 – 30- 82406-394

Abstract

We investigate how accurate parents are at predicting their children's meal preferences and what cues best describe parents' predictions. In Study 1 30 parents predicted their children's school lunch choices from actual school menus. Parents' prediction accuracy matched the stability of children's meal choices (assessed in a 4-month retest), implying that accuracy was as high as can be expected. Parents appeared to make their predictions by using specific knowledge about their child's likes and by projecting their own preferences. In Study 2, we asked 58 parents to predict their children's preferences for 30 randomly drawn school meals, and compared them to the children's actual preferences. Again, parents showed high prediction accuracy and predicted the lunches their children liked correctly more often than the disliked ones. Overall, parents' accuracy in predicting their children's food preferences was as good as or better than found in previous preference prediction studies that used less ecologically relevant task domains.

Key words:

Preference prediction, food choice, parents and children, projection, healthy food, family paradox

Introduction

Children do not intuitively know what foods are good for them (Galef, 1991; Story & Brown, 1987). If they were allowed to choose their food freely they would opt for sweet and salty tastes (Desor, Greene, & Maller, 1975) as well as high-fat foods (Birch, 1992; Mela, 1992). In reality, children typically do not get to choose their food without restrictions (Birch, 1989; Robinson, 2000; Wansink, 2006). To ensure that children actually eat a healthy variety of foods, it is advantageous if parents have knowledge of both what their children like and what is good for them, so that they can find healthy food compromises (as described by Lowenberg as early as 1948). Sometimes parents will not know for certain if their child likes a particular food when deciding whether or not to serve it. In these situations, parents need to predict their children's food preferences.

In this article we investigate how accurately parents predict their children's food choices and which prediction cues describe best how they make their predictions. We extend previous research on preference prediction in three ways: First, we consider the little-explored ability of parents to predict preferences of their young children. Second, we investigate the prediction domain of food choice, which is of high daily relevance for the person making a prediction (the so-called 'agent') and the person whose preferences are predicted (the 'target'). Results from previous prediction studies in less consequential domains may not generalize to this domain. Third, we compare parents' prediction accuracy for their children's lunch likes with that for their dislikes; as we lay out later these skills may play a role for the variety of different foods children get exposed to.

Prediction Accuracy

Past research in marketing and social psychology has found that people's general ability to predict others' preferences in domains not related to food is often relatively low (Alba & Hutchinson, 2000). Hoch (1987) asked participants to predict the attitudes, interests, and purchase behaviors of their spouses, their peers (married MBA students), and the average American consumer. Preferences and predictions were stated on a Likert scale; predictive accuracy was measured as the correlation between agents' predictions and the stated preferences of the targets. The predictive accuracy for the average American consumer was $r = 0.08$, while peers were predicted with an accuracy of $r = 0.53$, and spouses with $r = 0.51$.

Swann and Gill (1997) found that prediction accuracies of preferences for activities such as room cleaning, going to a bar, or playing board games were slightly higher for couples ($r = 0.57$) than for roommates ($r = 0.44$). In a series of four different experiments, Davis, Hoch, and Ragsdale (1986) found spouses' average accuracy of predicting each other's liking of new product concepts to be around $r = 0.27$. Also, West (1996) found that students who did not know each other predicted the other's preference for quilt patterns with an accuracy of about $r = 0.15$ and $r = 0.25$; when they received feedback on the target's quilt pattern preferences over 100 trials, their accuracy improved significantly (up to around $r = 0.50$ and $r = 0.80$). From yet another study, Lerouge and Warlop (2006) concluded that student couples had rather low prediction accuracy when forecasting their partner's bedroom furniture preferences.

Fagerlin and colleagues (2001) reported that adult children's forecasts of whether their parents would want life-sustaining medical treatment were between 64 and 72% accurate across scenarios. As there were only two alternatives to choose from, chance level was 50%. Wallin, Fasolo, and McElreath (2007) found that accuracy of predicting what drink a friend would like at a café was 49% (chance level = 14%).

Likes versus Dislikes

One aspect of prediction that has received little attention in the literature so far is whether agents are better at predicting targets' dislikes or likes. Parents presumably want to take both their child's likes and dislikes into account when deciding what foods to buy and serve to them. But a given parent may aim for a particular balance in getting the likes versus dislikes right. Some parents may prefer to err on the side of optimism, predicting more often that their child will like a novel food. This will lead the parent to expose her child to more new foods, but will also increase the number of false positives—foods that parents think their child will like but that are actually met with disapproval. Other parents may adopt a conservative strategy, more often predicting their child will dislike a novel food. This may result in fewer rejected meals but will also result in more misses of foods that the child may actually have liked if given the opportunity to try it.

Stability of Preferences

Prediction accuracy is also impacted by the stability of preferences over time—specifically, preference prediction accuracy can usually not exceed preference stability. For example, the 2-week retest-reliability of preference ratings for new consumer products has been found to be $r_{test\text{-}retest} = 0.7$ (Davis et al., 1986). Thus the reliability of preferences can be seen as one benchmark for prediction accuracy (Guilford, 1954). In a number of domains, this stability has been shown to be limited. One could argue that if a predictor was aware of the situational influences that systematically alter the target's preferences over time and thereby diminish preference stability, he could adjust his predictions and achieve even higher accuracy. However, in the food domain there are numerous situational influences (e.g., social influences—Clendenen, Herman, & Polivy, 1994—and environmental factors—Hill, Wyatt, Reed, & Peters, 2003) that would be

very difficult to take entirely into account. Therefore preference stability remains an important constraint on prediction accuracy in this domain.

Benchmark Criteria for Prediction Accuracy

To obtain a comparison standard for the accuracy of an agent's predictions of the target's preferences we can compare it to the following benchmark criteria:

Accuracy of agent's predictions when applied to all other targets in a study. This benchmark helps disentangle predictions that were specifically tailored to one target from those that follow from a "psychological baseline" (Gage & Cronbach, 1955) of more stereotypical knowledge about the preferences of the target group in general.

Accuracy of a hypothetical base-rate forecaster. The "hypothetical base-rate forecaster" (Hoch, 1985, p. 724) predicts that every target prefers the option that is most popular among all targets. Thus, predictions are based on aggregate knowledge comparable to that of a marketing department tracking sales of products and do not take individual target differences into account.

Prediction Cues

If a person knows exactly what another person likes, this specific knowledge of the other's preference renders strategies or cues for prediction unnecessary. However, when predicting agents are not certain about a target's preferences, they may still have access to a number of cues that are correlated to those preferences (Brunswik, 1955; Hoch, 1988). In familiar domains, such as school lunch preferences in our studies, it is difficult to disentangle agents' use of particular probabilistic cues for making predictions from the use of specific knowledge about the agents' precise preferences. It is not clear whether agents relied on specific knowledge or on a cue to make a prediction. Nonetheless, from these studies we can still tell whether parents could have

made more accurate predictions by relying on particular cues. We consider two possible cues here:

Agent's own preferences. To the degree that the agent perceives himself as similar to the target, he can successfully project his own likes and dislikes onto the target and use them as the basis for making a prediction (Gershoff & Johar, 2006).

Healthfulness. The literature on the role of healthfulness in food choice of children and parents is inconclusive. Some research shows that healthfulness is a very important cue in food choice for everybody (Wardle, Parmenter, & Waller, 2000); while some scholars propose that it is totally insignificant for food decisions (Noble, Corney, Eves, Kipps, & Lumbers, 2000, 2003). Whether or not children use this cue to make their food choices, parents may still use it to make their predictions of their child's preferences.

Estimates of Prediction Accuracy

It is important for predictors to know how good they are at the prediction task, so that they can decide when they should make a prediction and when they should delay their decision until they have the opportunity to follow some other strategy, such as asking directly for the preference of the target individual. Previous studies (Alba & Hutchinson, 2000; Dunning, Griffin, Milojkovic, & Ross, 1990; Gershoff & Johar, 2006; Swann & Gill, 1997) have shown that adults generally estimate their prediction accuracy to be higher than it actually is. Participants in such studies may judge the quality of their prediction task performance from their typically accurate experience in their natural environment and hence overestimate their accuracy on the more difficult experimental tasks (Gigerenzer, Hoffrage, & Kleinbölting, 1991). We expect participants in our studies to be better at estimating their prediction accuracy because of their familiarity with the food preference task.

Particularities of Parents' Predictions of Children's Meal Preferences

Given the lack of past prediction studies that have looked at the parent–young children relationship in the food domain, we have to turn to some basic considerations to conjecture about parents' accuracy regarding their children's meal preferences. But these factors do not suggest a common conclusion. First, most parents provide meals for and frequently eat together with their children. This implies that predicting their children's preferences is a very familiar task that parents should be fairly good at. Second, parents control the food intake of their children and provide a large portion of the food environment (foods a child knows or is regularly exposed to—Nicklas et al., 2001). Consequently, children may develop an increased liking for food to which they have repeated exposure (Birch & Marlin, 1982) but sometimes also for a restricted food (Fisher & Birch, 1999) which complicates parents' prediction task.

A third factor particular to this domain is that children often have different food preferences from adults in general and their parents specifically. Several studies report weak or absent resemblance in food likes between parents and their own children—a phenomenon known as the "family paradox" (Birch, 1980a; Pliner & Pelchat, 1986; Rozin, 1991; Rozin & Vollmecke, 1986). As outlined above, most previous prediction studies looked at adults predicting other, often familiar adults, and the extent to which agents were similar to targets would mean that projecting their own preferences was a reasonable prediction strategy. But given that adults are less similar to children than to other adults generally (Birch, 1999), and given the particular parent–child divergence in food tastes, this strategy is unlikely to work well in the situation we explore. Are parents aware of this problem and do they adapt their prediction cues accordingly?

Research Questions

Based on the theory and findings described above, we investigated the following research questions:

How accurately do parents predict their children's meal preferences? What cues underlie parents' predictions of their children's meal preferences? Do they project their own preferences? Do they predict meal choices they perceived as most healthful?

When predicting their children's meal choices, do parents prefer to have fewer "false alarms" (serving disliked foods) than "misses" (not serving a liked food)?

How well do parents estimate their accuracy at predicting their children's meal choices?

Methods

To answer these research questions, we conducted two empirical studies. Study 1 is a field study on actual food choices that children face on a daily basis. While this first study ensured high ecological validity, it restricted experimental control. Therefore, we conducted a second, more controlled study that also allowed assessing additional variables.

Study 1

Design and procedure. Our first study was conducted at a primary school where meal plans for the school lunch canteen were issued bi-weekly. Lunch choices included meals such as "2 fried sausages with paprika sauce, mashed potatoes and peas" or "spaghetti with tomato sauce". The children take the meal plans home and commonly choose together with their parents which lunch they want to have on each school day for the upcoming two weeks. The children get their daily lunches based on their choices on this meal plan. For the study, we gave children the actual school meal plan (Meal Plan 1) for the upcoming two weeks along with a second school meal plan (Meal Plan 2)

from a different caterer supplying a number of other local schools. None of the meals were repeated. While they were in class, the children were asked (1) to circle for each day of their school lunch plan the dish that they would choose from the two offered each day; (2) to mark which dish they would choose for each day from the second lunch plan, which had four menu options for each day; and (3) on another copy of the second lunch plan, to circle the dish they thought was healthiest on each day. Children were furthermore asked for their grade, sex, birth date and whether they usually bought lunch at the school canteen.

The children were then given questionnaires to take home for one parent to fill out. Parents received the same meal plans as their children. For both meal plans they stated which meal they would want for themselves and predicted the lunch they thought their child would choose. For the second meal plan, as did the children, they also marked the daily meal they judged as most healthful. Parents were further asked for the birth date and sex of their child, whether he or she was enrolled in the school lunch program, and how many times per week the parent and child had breakfast and dinner together. Children were asked not to help their parents fill out the questionnaires and instructions told the parents that the study would not work if they did it together with their child. The children then brought the questionnaires back to school and gave them to their teachers for delivery to the authors via mail.

The principal of the school had informed parents, students, and teachers about the study in advance. Agreement to participate was obtained from everyone who took part in the study. The meeting with the children took place during school lessons and lasted between 30 and 40 min. The experimenters gave instructions to the children, stayed in the classroom throughout the session, and ensured that students did not discuss their meal preferences with each other.

To measure preference stability, children's lunch preferences over the same meal choices were reassessed after 4 months. Due to time constraints only Meal Plan 2 was given to the students on this occasion. Children were again asked to circle which meal they would choose for each day.

Participants. Participants were primary school students from Kleinmachnow (a city close to Berlin, Germany) and one of each child's parents. Out of the 100 students in grades 3 to 6, 30 agreed to participate. These students were between 8 and 11 years old with a mean age of 10 years, and 18 were male. Of their participating parents, 14 were fathers, 9 were mothers, and 7 did not identify their sex.

Sixteen of the initial 30 students participated in the follow-up study 4 months later. The others either were not present at school that day or their meal plans could not be matched with the previous questionnaires.

Study 2

Design and procedure. In our second study, we randomly selected 30 meals out of 6 months' worth of school meal plans for Berlin schools (using menus from the same two caterers as in Study 1). Parents and children who agreed to participate in the study (recruited from a university science event as described below) were separated and seated at tables on opposite sides of a large classroom and received questionnaires containing the 30 meals.

In contrast to Study 1, where participants just chose one lunch at a time out of a two- or four-option meal plan, children in Study 2 were asked to indicate the degree to which they liked to eat each of the meals using a 4-category preference scale ("don't like it at all", "don't like it very much", "like it", "like it very much"). This is a more fine-grained measure of preference as, for example, participants in Study 1 might have liked two meals equally well, or disliked all of them but were nonetheless forced to

choose one. Asking for a rating of every dish also allowed us to assess parents' prediction accuracy for likes versus dislikes.

Correspondingly, parents in Study 2 also rated how much they themselves liked each meal and predicted how much their child liked the meals based on the 4-categeory preference scale. Parents further stated how often they ate together with their child, how many of their meal choices (0–30) they thought were the same as those of their children (preference similarity), and how many of their children's meal preferences they thought they had predicted correctly. Every participating child received a prize (a children's book or a computer game).

Participants. Participants were visitors at the Freie Universitaet of Berlin's "Long Night of Sciences," an open house hosted by local universities and other scientific institutions in Berlin, Germany, where scientists present their research to the general public. Fifty-eight children and one of their parents participated. Children had a mean age of 10.7 years (SD = 2.9 years). Of the children, 62% were girls, and of the parents, 70% were mothers.

Analyses of Data

Analyses were similar for Study 1 and 2. To calculate prediction accuracy we assessed for every parent–child dyad how often the parent's prediction matched the child's choice and then averaged percentage of agreement across all pairs. To estimate similarity between parents' and children's preferences and thus whether parents could have improved their predictions by relying on similarity in preferences or perceived healthfulness of meals, we counted how often parents' choices for themselves, and separately their perception of meal healthfulness, matched their children's own preferences.

Results

Results for Studies 1 and 2 are summarized in Tables 1 and 2, respectively.

Missing Data

In Study 1, 8% of all answers concerning the school lunch menus were missing (*children*: Meal Plan 1: 10%, Meal Plan 2: 7%; *parents*: Meal Plan 1: 8%, Meal Plan 2: 6%). Missing values were handled by assigning the total number of answers each participant gave as the 100% level, independent of how many answers were missing (i.e., if a child only marked his meal preference for 8 out of the 9 days, and the child's parent predicted these 8 meal choices correctly, prediction accuracy was counted as 100%). Three children did not fill out their preferred lunch choices in Meal Plan 1 and were excluded from the analysis of that plan, and two parents did not predict their children's lunch preferences in Meal Plan 2 and were excluded from the analysis of that plan.

In Study 2, 5% of the answers were missing (9% of the children's answers, and 3% of the parents' answers), because children did not recognize the meal, or parent or child did not fill out a particular item. As in Study 1, percentages of accuracies or matches refer to the percentage of the available data.

Prediction Accuracy

In Study 1, for their children's actual two-choice school meal plan (Meal Plan 1), parents predicted on average 73% of their children's meal preferences correctly (chance = 50%). In the unfamiliar four-choice menu from another Berlin school (Meal Plan 2), parents were correct for 46% of the meals on average (chance = 25%).

When prediction accuracies for the two-option menu and the four-option menu are adjusted separately to take the different chance levels[1] into account, making results comparable across the two meal plans, prediction accuracy was on average 46% (Meal

Plan 1) and 28% (Meal Plan 2) better than random guessing. Thus, prediction accuracy was higher in the familiar meal plan (Meal Plan 1) than in the unfamiliar one. However, this difference was not statistically significant on the α-level of 0.05 which is assumed throughout all subsequent statistical analyses, $t(24) = -1.79$, $p = 0.09$, *Cohen's d* = 0.35. Finally, how often parents and children ate together was not associated with parents' prediction accuracy (Meal Plan 1: $r = 0.04$, $p = 0.84$; Meal Plan 2: $r = -0.14$, $p = 0.47$).

In Study 2, parents on average predicted 52% of their children's preferences correctly (i.e., predicting their child's exact answer on the 4-category scale). Using the correction formula applied earlier, this is 36% better than chance. As in Study 1, how often parents and children ate together was not related to parents' prediction accuracy ($r = 0.04$, $p = 0.79$).

Estimates of prediction accuracy. Overall, 55% of the parents in Study 2 underestimated their prediction accuracy by on average 24% (*SD* = 13%), while 43% overestimated it by an average of 28% (*SD* = 23%), and one parent perfectly estimated her prediction accuracy. These results suggest that people had difficulties estimating their prediction accuracy but were not generally overconfident about their performance.

Comparison with benchmark criteria. We compared parents' prediction accuracy for their own child with how well their predictions matched the meal choices of all other children in the study[2]. In Study 1, for the familiar two-option Meal Plan 1, parents' predictions on average matched 65% of the other children's meal choices, compared to the 73% accuracy for predicting their own child. This difference is statistically significant, $t(24) = 2.50$; $p = 0.02$, $d = 0.50$. In the unfamiliar four-option menus (Meal Plan 2), parents' mean accuracy for other children's choices was 36%, which again is significantly lower than the 46% accuracy for their own children on those menus, $t(27) = 2.31$, $p = 0.03$, $d = 0.44$. This suggests that at least some of the

parents' meal predictions were based on information specific to the relationship between the parents and their own child.

In Study 2, parents' predictions of how much their own child liked a meal matched the preferences of all other children on average 36% of the time on the 4-category scale. This is significantly lower than the 52% prediction accuracy for their own child, $t(57) = 8.7$; $p < 0.01$, $d = 1.0$, indicating again that some aspect of their specific relationship with their child guided parents' predictions.

For Meal Plan 1 in Study 1, prediction accuracy of the hypothetical base-rate forecaster was on average 70%, which is comparable to parents' 73% accuracy, $t(53) = 0.45$, $p = 0.65$, $d = 0.12$. For Meal Plan 2, the hypothetical base-rate forecaster predicted with 50% accuracy, again not different from parents' prediction accuracy of 46%, $t(56) = -0.76$, $p = 0.49$, $d = 0.2$.

In Study 2, the mean prediction accuracy of the hypothetical base-rate forecaster was 45%. In this case, parents were better at predicting their children's preferences, $t(114) = 2.97$, $p < 0.01$, $d = 1.04$.

Reliability of children's preferences. Preference reliability was assessed for Meal Plan 2 in Study 1. Here, the 16 children who filled out the preference retest four months later did not differ from the children who did not participate in the retest in terms of sex, $\chi^2(1,30) = 0.20$, $p = 0.72$, $\varphi = 0.08$, how often they ate at the canteen, $\chi^2(1, 30) = 1.10$, $p = 0.42$, $\varphi = 0.19$, or how accurately their parents predicted their preferences at the first measurement point, $t(26) = 1.17$, $p = 0.25$, $d = 0.45$. Therefore we assume that children's reliability and parents' prediction accuracy assessed at the second measurement point can be generalized to the entire sample.

Retest reliability was on average 51% (SD = 21%), meaning that after four months, only about half of the choices were identical with the first measurement point. For the other half, children chose a different dish. Therefore parents' prediction

accuracy in general could not be much higher than 51% (again with chance performance on the four dishes being 25%). We compared parents' prediction accuracy for their children's choices at Time 1 with accuracy for preferences at Time 2 and found that the predictions parents had made at the first measurement point correctly predicted on average 55% of children's meal choices at the second measurement point (not significantly different from children's preference stability, $t(15) = -0.64$, $p = 0.53$, $d = 0.16$, nor from these parents' prediction accuracy for their children's meal choices at first measurement point, $t(15) = -1.03$, $p = 0.32$, $d = 0.28$). The finding that parents' prediction accuracy was about as high as children's preference reliability implies that parents performed about as well as possible.

Enter Tables 1 and 2 about here

Prediction accuracy of likes versus dislikes. To test parents' prediction accuracy for likes versus dislikes, we dichotomized the preference scale used in Study 2 (scale values "like it" and "like it very much" versus "don't like it at all" and "don't like it very much"). Overall, children on average liked 63% of the 30 meals, and parents on average predicted that their child would like 64% of the meals. We took the different base rates of likes and dislikes into account by separately calculating how many of the children's likes parents predicted correctly and how many of their dislikes were predicted correctly. Parents were more often correct in predicting likes than in predicting dislikes: On average across all dyads, 86% (SD = 11%) of all likes and 68% (SD = 24%) of all dislikes were predicted correctly, $t(57) = 5.2$, $p < 0.01$, $d = 0.65$.

On an individual level looking at erroneous predictions, we found that the majority of the parents (72%) more often predicted a dislike to be a like and thus assumed that their children liked more dishes than they actually did (26% of parents

showed the reverse pattern and 2% as often mistook a like for a dislike as vice versa). These results imply that most parents facing uncertainty as to whether a meal will be fancied by their child assume that their child will like it. This 'optimistic' attitude would lead parents to expose their children to a larger variety of foods.

Cue Use

Projection. To find out whether parents could have improved their prediction accuracy by using their own preferences as a cue more often we looked at the similarity between the meal preferences of each parent and their child. If this similarity is higher than the parent's prediction accuracy, then that parent could have improved his or her accuracy by projecting own preferences more often.

For Meal Plan 1 in Study 1, parents on average preferred the same meal as their child in 57% of all cases (SD = 20%). This number is significantly lower than the mean parent prediction accuracy of 73%, $t(24) = -3.55$, $p < 0.01$, $d = 0.63$, and implies that on average parents could not have improved their prediction accuracy by projecting more. Assessed at the individual level, only 15% of the parents could have improved their prediction accuracy by projecting more often (because their similarity was higher than their prediction accuracy). For Meal Plan 2, parents had the same meal preference as their children in 37% ($SD = 21\%$) of the cases. Again, this number is significantly lower than their mean prediction accuracy of 46%, $t(27) = -2.01$, $p = 0.05$, $d = 0.39$. On this second meal plan, only 36% of the parents could have improved their prediction accuracy by projecting more often.

In Study 2, four parent–child dyads were excluded from the analysis because parents had not stated their own preferences. Parents' similarity with their children's meal preferences was on average 30% (SD = 14%), and as in Study 1, parents' prediction accuracy was significantly higher than their actual similarity, $t(57) = -6.60$, p

<0.01, d = 1.15. Only 21% of the parents could have improved their prediction accuracy by projecting their own meal preferences more often.

Healthfulness. Children's choices for Meal Plan 2 in Study 1 matched the meal they identified as most healthful in 34% of the cases (SD = 27%). Similarly, meals that parents found to be most healthful matched their children's actual meal choices in 30% (SD = 22%) of the cases, which is significantly lower than parents' actual prediction accuracy, $t(26) = 3.04$, $p < 0.01$, $d = 0.57$. Furthermore, parents' and children's agreement on which meals are healthiest was 33% (SD = 19%). Overall, only 36% of the parents could have improved their prediction accuracy by using the cue of meal healthfulness more often. Together, these results suggest that healthfulness is not a good cue for children's meal choices and their prediction.

Discussion

Through two studies in which we asked children and their parents to make realistic meal choices, we explored how well parents predicted their child's lunch choices, how well they thought they knew their child's preferences, how accurate they were at predicting likes versus dislikes, and which cues may have been involved in their predictions. We discuss our findings on each of these research questions in turn.

Prediction Accuracy and Estimates of Prediction Accuracy

We found that on average, parents' prediction accuracy for their child's meal preferences was about as high as it could be given children's relatively unstable meal preferences over time. Prediction accuracy in our studies was higher than the accuracies reported in many previous studies on preference prediction. Parents' predictions for their own child were generally better than the benchmark criteria we measured, namely the hypothetical base-rate forecaster, and accuracy of agents' predictions when applied to all other targets in each of the studies, indicating that specific knowledge about the

target (the parent's own child) plays a role. Our results suggest that agents can predict a target's preferences more accurately if the prediction domain is a familiar one where predictions are common. We also found that on this ecologically valid and relevant task parents did not generally overestimate their prediction accuracy. This is in contrast to results of many previous studies suggesting that people are generally overconfident in their abilities (e.g, Alba & Hutchinson, 2000).

The fact that parents' prediction accuracy was reasonably good overall in this task is all the more surprising given the factors that make it challenging: Food choice depends greatly on situational influences, including social factors (Clendenen et al., 1994; Herman, Roth, & Polivy, 2003), environmental factors (Hill et al., 2003), the variety of food eaten recently, and whether the food was chosen day-by-day or in advance for an upcoming period (Kahnemann & Snell, 1992; Simonson, 1990). These influences distinguish food from many other consumer goods including those investigated in the preference prediction studies discussed earlier, making preferences more likely to vary over time, and thus more difficult to predict. Furthermore, according to the "family paradox", parents' food preferences frequently differ from those of their children (Rozin, Fallon, & Mandell, 1984; Rozin, 1991). This limits the possibility of using projection of own preferences, which has been found to be a successful prediction strategy in some other domains not related to food (Hoch, 1987). Finally, children's food preferences are influenced by those of their peers (Birch, 1980b). Because school lunches of the sort we investigated are presented in a setting where children eat together with their peers rather than with their parents, these social influences can create context-specific preferences that parents might not be aware of.

Predicting Likes and Dislikes

Parents were better at predicting which meals their children liked than which they disliked. This is surprising because from the theoretical perspective of information theory, rarer events, such as dislikes in our studies, are considered informative (Shannon, 1948). Also, insofar as children might communicate dislikes with more emphasis than likes, they should be better remembered (Eisenhower, Mathiowetz, & Morgenstein, 1991). However, West (1996) argues that the informativeness of an event also depends on the costs of the particular prediction error one can commit regarding that event, be it a false positive or false negative. Given that about three-quarters of the parents in Study 2 were more likely to predict that a meal will be liked rather than disliked when they are in doubt about their child's preference, missing a liked meal may have been perceived as more costly than the erroneous assumption of a dislike. Thus, parents may have put more value on exposing their children to a large variety of different foods.

Cue Use

In both studies, parents' predictions seemed to arise through the use of specific knowledge of their children's preferences and possibly also through some projection of their own preferences. Healthfulness of meals did not seem to be a particularly useful cue for parents' predictions. One reason for this finding could be the low agreement between parents and children on which food is healthiest. An alternative explanation is that the majority of lunches on the meal plans we used may have appeared to be equally healthful, and therefore healthfulness might not have been a differentiating cue for parents' predictions. In general, whether or not parents based some of their child's meal predictions on cues including their own preferences or perceived healthfulness, they could not have improved prediction accuracy further by relying on them more often.

Limitations

Especially in Study 1, the statistical power to detect medium to large effects was sometimes low due to the small sample size. Also, in Study 1 almost half of those parents who reported their sex were fathers. In many households fathers spend less time with children than mothers, including food related activities (Sayer, Bianchi & Robinson, 2004). Thus, the fact that so many fathers filled out our meal plan questionnaires might have led to a lower overall prediction accuracy in Study 1. An alternative interpretation of the high number of participating fathers is that these particular individuals were more involved in household chores or child upbringing than in many other families. Furthermore, in Study 2 our participants were visitors at a scientific event, and thus may have had a socio-economic status above average. This, together with the composition of participating parents in Study 1, might limit generalizability of our findings to more diverse populations.

Conclusions

Contrary to the pessimistic conclusions of previous studies, people may not be so bad at predicting the preferences of others after all—if they do it in situations where preference prediction naturally occurs most often, namely for targets who are very familiar and in a domain that is of daily importance. More specifically, parents have the ability to accurately predict both, likes and dislikes. This knowledge is essential for parents to be able to make necessary healthful food compromises that children do not seem to make if the meal choice is left to them alone (Klesges et al., 1991). Thus, parents' predictions of children's food preferences not only constitute an interesting domain for studying prediction accuracy and cue use—they are also crucial to the ongoing discussion about how to help children eat a healthier diet and how to help parents support their children in this effort.

Acknowledgments

This work was supported by a scholarship of the International Max Planck Research School “The Life Course: Evolutionary and Ontogenetic Dynamics (LIFE)” to the first author. We would like to thank the school principal and teachers who allowed us to conduct our research in their school as well as all parents and children who participated in these studies. We thank Linda Miesler for her help in preparing the studies and collecting data, Rui Mata and Tim Pleskac for advice on data analyses, Brian Wansink, David Funder, and Paul Rozin for helpful comments on an earlier draft, and Anita Todd for editing the manuscript.

References

Alba, J. W., & Hutchinson, J W. (2000). Knowledge calibration. What consumers know and what they think they know. *Journal of Consumer Research, 27*, 123–156.

Birch, L. L. (1980a). The relationship between children's food preferences and those of their parents. *Journal of Nutrition Education, 12*, 14–18.

Birch, L. L. (1980b). Effects of peer models' food choices and eating behaviors on pre-schoolers' food preferences. *Child Development, 51*, 489–496.

Birch, L. L. (1989). Developmental aspects of eating. In R. Sheperd (Ed.), *Handbook of the psychophysiology of human eating* (pp. 179-205). Chichester: Wiley.

Birch, L. L. (1992). Children's preferences for high fat-foods. *Nutrition Reviews, 50,* 249–255.

Birch, L. L. (1999). Development of food preferences. *Annual Review of Nutrition, 19*, 41–62.

Birch, L. L., & Marlin, D. W. (1982). I don't like it; I never tried it: Effects of exposure to food on two-year-old children's food preferences. *Appetite, 3,* 353–360.

Brunswik, E. (1955). Representative design and probabilistic theory in a functional psychology. *Psychological Review, 62*, 193-217.

Clendenen, V. I., Herman, C. P., & Polivy, J. (1994). Social facilitation of eating among friends and strangers. *Appetite, 23,* 1–13.

Davis, H. L., Hoch, S. J., & Ragsdale, E. K. E.. (1986). An anchoring and adjustment model of spousal predictions. *Journal of Consumer Research*, *13*, 25–37.

Desor, J. A., Greene, L. S., & Maller, O. (1975). Preferences for sweet and salty in 9 year-old to –15 year old and adult humans. *Science, 190*, 686–687.

Dunning, D., Griffin, D. W., Milojkovic, J. D., & Ross, L. (1990). The overconfidence effect in social prediction. *Journal of Personality and Social Psychology, 58*, 568–581.

Eisenhower, D., Mathiowetz, N. A., & Morgenstein, D. (1991). Recall error: Sources and bias reduction techniques. In P. P. Bieber, R. M. Groves, L. E. Lyberg, N. A. Mathiowetz, & S. Sudman (Eds.), *Measurement errors in surveys* (pp. 127–144). New York: Wiley.

Fagerlin, A., Ditto, P. H., Danks, J. H., Houts, R. M., & Smucker, W. D. (2001). Projection in surrogate decisions about life-sustaining medical treatments. *Health Psychology. 20*, 166–175.

Faith, M. S., Scanlon, K. S., Birch, L. L., Francis, L. A., & Sherry, B. (2004). Parent-child feeding strategies and their relationships to child eating and weight status. *Obesity Research, 12*, 1711–1722.

Fisher, J. O., & Birch, L. L. (1999). Restricting access to palatable foods affects children's behavioral response, food selection, and intake. *American Journal of Clinical Nutrition, 69,* 1264–1272.

Fleiss, J. L. (1975). Measuring agreement between two judges on the presence or absence of a trait. *Biometrics, 31*, 651-659.

Gage, N. L., & Cronbach, L. J. (1955). Conceptual and methodological problems in interpersonal perception. *Psychological Review, 62*, 411–422.

Galef, B. G., Jr. (1991). A contrarian view of the wisdom of the body as it relates to dietary self-selection. *Psychological Review, 98*, 218–223.

Gershoff, A. D., & Johar, G. V. (2006). Do you know me? Consumer calibration of friends' knowledge. *Journal of Consumer Research*, *32*, 496–503.

Gigerenzer, G., Hoffrage, U., & Kleinbölting, H. (1991). Probabilistic mental models: A Brunswikian theory of confidence. *Psychological Review, 98*(4), 506–528.

Guilford, J. P. (1954). *Psychometric methods.* New York: McGraw-Hill.

Herman, C. P., Roth, D. A., & Polivy, J. (2003). Effects of the presence of others on food intake: A normative interpretation. *Psychological Bulletin, 129*(6), 873-886.

Hill, J. O., Wyatt, H. R., Reed, G. W., & Peters, J. C. (2003). Obesity and the environment: Where do we go from here? *Science, 299,* 853–855.

Hoch, S. J. (1985). Counterfactual reasoning and accuracy in predicting personal events. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 11*, 719–731.

Hoch, S. J. (1987). Perceived consensus and predictive accuracy: The pros and cons of projection. *Journal of Personality and Social Psychology, 53*(2), 221–234.

Hoch, S. J. (1988). Who do we know: Predicting the interests and opinions of the American consumer. *Journal of Consumer Research: An Interdisciplinary Quarterly*, *15*(3), 315–24.

Kahneman, D., & Snell, J. (1992). Predicting a changing taste: Do people know what they will like? *Journal of Behavioral Decision Making, 5*, 187–200.

Klesges, R. C., Stein, R. J., Eck, L. H., Isbell, T. R., & Klesges, L. M. (1991). Parental influence on food selection in young children and its relationship to childhood obesity. *American Journal of Clinical Nutrition, 53*, 859–864.

Lerouge, D., & Warlop, L. (2006). Why it is so hard to predict our partner's product preferences: The effect of target familiarity on prediction accuracy. *Journal of Consumer Research*, *33*, 393–402.

Lowenberg, M. E. (1948). Food preferences of young children. *Journal of the American Dietietic Association*, *24*, 430–435.

Mela, D. J. (1992). *Dietary fats.* Essex, UK: Elsevier Science.

Nicklas, T. A., Baranowski, T., Baranowski, J. C., Cullen, K., Rittenberry, L., & Olvera, N. (2001). Family and child-care provider influences on preschool children's fruit, juice and vegetable consumption. *Nutrition Reviews, 59,* 224–235.

Noble, C., Corney, M., Eves, A., Kipps, M., & Lumbers, M. (2000). Food choice and school meals: Primary schoolchildren's perceptions of the healthiness of foods and the

nutritional implications of food choices. *International Journal of Hospitality Management, 19*(4), 413–432.

Noble, C., Corney, M., Eves, A., Kipps, M., & Lumbers, M. (2003). Food choice and secondary school meals: The nutritional implications of choices based on preferences rather than perceived healthiness. *International Journal of Hospitality Management*, *22*(2),197–215.

Pliner, P., & Pelchat, M. L. (1986). Similarities in food preferences between children and their siblings and parents. *Appetite, 7*, 333–342.

Robinson, S. (2000). Children's perceptions of who controls their food. *Journal of Human Nutrition and Dietetics, 13,* 163–171.

Rozin, P. (1991). Family resemblance in food and other domains: The family paradox and the role of parental congruence. *Appetite, 16*(2), 93–102.

Rozin, P., Fallon, A., & Mandell, R. (1984). Family resemblance in attitudes to food. *Developmental Psychology, 20*(2), 309–314.

Rozin, P., & Vollmecke, T. A. (1986). Food likes and dislikes. *Annual Review of Nutrition*, *6*, 433–456.

Sayer, L. C., Bianchi, S. M., & Robinson, J. P. (2004). Are Parents Investing Less in Children? Trends in Mothers' and Fathers' Time with Children. *American Journal of Sociology, 110*(1), 1–43.

Shannon, C. E. (1948). A mathematical theory of communication. *The Bell System Technical Journal, 27*, 379–423, 623–656.

Simonson, I. (1990). The effect of purchase quantity and timing on variety-seeking behavior. *Journal of Marketing Research, 27*(2), 150–162.

Story, M., & Brown, J. E. (1987). Do young children instinctively know what to eat? The studies of Clara Davis revisited. *The New England Journal of Medicine, 316*, 103–106.

Swann, W. B., Jr., & Gill, M. J. (1997). Confidence and accuracy in person perception: Do we know what we think we know about our relationship partners? *Journal of Personality and Social Psychology, 73*, 747–757.

Wallin, A., Fasolo, B., & McElreath, R. (2007). *Errors in the prediction of preferences: Simulation and theory in adult mindreading.* Manuscript submitted for publication.

Wardle J., Parmenter K., & Waller J. (2000). Nutrition knowledge and food intake. *Appetite, 34*(3), 269–275.

Wansink, B. (2006). Nutritional gatekeepers and the 72% solution. *Journal of the American Dietetic Association, 106*(9), 1324–1327.

West, P. M. (1996). Predicting preferences: An examination of agent learning. *Journal of Consumer Research, 23*(June), 68–80.

Table 1

Accuracy (% correct) of parents and benchmark criteria for predictions of children's meal choices in Study 1.

	Meal Plan 1 (2 options; chance level=50)	Meal Plan 2 (4 options; chance level=25)
Parents' prediction for own child	73 (19)	46 (22)
Parents' predictions for all other children	65 (11)	36 (7)
Hypothetical base-rate forecaster	70 (28)	50 (18)
Parents' prediction for own child at 4-month retest	—	55 (20)

Note. Mean (SD) shown in each applicable cell. Accuracy of prediction of parents and benchmark criteria are all significantly different from chance level at a $p < 0.01$, for both meal plans.

Table 2

Accuracy (% correct) of parents and benchmark criteria for predictions of children's meal choices in Study 2.

	Menu list (4-category scale; chance level=25)
Parents' prediction for own child	52 (14)
Parents' predictions for all other children	36 (3)
Hypothetical base-rate forecaster	45 (13)

Note. Mean (SD) shown. Accuracy of prediction of parents and benchmark criteria are all significantly different from chance level at a $p < 0.01$.

Footnotes

[1] Data were corrected for chance level with the following formula: $p = (p'-C) / (1-C)$, where p is the probability corrected for chance, p' is the raw probability and C is the chance level (cf. Fleiss, 1975).

[2] Each parent's meal prediction was compared with the meal choices of all children except their own. The average prediction accuracy over all predicted children was taken as the parent's prediction accuracy for other children.

General Discussion

Who is to blame for the obesity epidemic in the Western world, the individual who is eating too much and moving too little, or the "obesogenic environment" (e.g., Swinburn & Egger, 2004, p. 736) that tempts people to consume soft drinks and chips in front of the TV? The answer depends on whom you ask. Researchers investigating consumer behavior (e.g., Wansink, 2004) or public health issues (e.g., French, Story, & Jeffery, 2001) often identify the environment, citing, for example, big package sizes, the omnipresence of high-calorie foods, and escalators. Many scientists with a background in social or health psychology are likely to lay responsibility on the individuals they are trying to help by encouraging physical activity and the consumption of more vegetables and fruits (e.g., Conner & Armitage, 2002; Schwarzer et al., 2007). The goal of this dissertation is to contribute to this ongoing debate by focusing on both the individual and the environment across three domains of food choice. It is of special interest to test environment factors against motivational and volitional processes across diverse domains because distinct environments vary in their structure and thus allow observing different ways of how the interaction between environment on the one side and motivation and volition on the other side affects food choice. Herbert Simon (1981) gave a vivid example of this interaction with his metaphor about the ant on the beach: The ant is trying to reach a distant food and her path for getting there seems very complicated, twisting and turning, and might suggest complex mechanisms about which direction to take – however taking the sandy surface into account, full of little grains the ant tries to avoid, it is easy to imagine simple mechanisms for her walking pattern. The results of this dissertation on food choice also suggest that both factors within the individual and aspects of the environment are powerful predictors for food-related decision making that should not be considered independently of each other.

In the following I will describe each article in turn. I briefly outline the main findings, discuss their implications for understanding the relationship between individual and environment

factors for food-related decision making, review advantages and disadvantages of the methods used, and suggest questions for future research. I wrap up discussing how this dissertation contributes to our understanding of decision making in the food domain and to the development of efficient intervention strategies to prevent (further increase in) overweight and obesity.

Diet Adherence

Individual or Environment?

In the first manuscript, "When Diets Last: Lower Cognitive Complexity Increases Diet Adherence," we extended previous research on how characteristics of the environment influence eating behavior by considering the cognitive environment, specifically the effect of weight loss rule complexity on diet adherence. We show that higher perceived cognitive complexity of diet rules considerably increases the probability that a woman will quit her diet prematurely. Despite a protective function of volitional factors, perceived computational complexity was responsible for the largest change in the odds of giving up. This study bridged the disciplines of cognitive science and health psychology by integrating findings about subjectively perceived and objectively measured cognitive complexity in a research project on weight loss. The results show that to understand dieting behavior, it is beneficial not to limit attention to factors of internal regulation but to take characteristics of the cognitive environment into account as well.

Methods: Measuring Environment

A number of researchers have pointed to the importance of eating environment to understand the rise in overweight and obesity (e.g., Brownell, 2002; Hill & Peters, 1998; Rozin, Kabnick, Pete, Fischler, & Shields, 2003). Environment analysis allows the researcher to quantify characteristics of the real-world context in which a person makes decisions and thus uncover links between environment features and the individual's choice behavior, potentially

explaining differences in behavior across situations and identifying which elements to tweak to make interventions more effective.

Rozin and colleagues advised psychologists to pay more attention to the food environment if they want to understand human eating. But how can environments be measured? Depending on the research question, the relevant environment has to be identified and assessed. For example, Rozin and colleagues (2003) measured and quantified available package sizes in supermarkets, portion sizes in restaurants, and recipes in cook books in the United States and France to shed light on the French paradox, the finding that the French are leaner than U.S. Americans, despite seemingly eating more high-fat food and drinking a higher amount of wine. In the health-care domain, Slaytor and Ward (1998) and Kurzenhäuser (2003) considered the "information environment" in their respective analyses of health brochures on mammography screening, to investigate its effect on the understandability and adequacy of information on possible risks and advantages of the test. In the course of this dissertation, we extended this notion of information environment to the complexity of the provided information, considering the amount of information that has to be remembered and the computations that have to be conducted to eat in accordance with the rules of a weight loss diet. We found that perceived complexity only partially corresponded to the environment complexity measured in diet books. This might be due to the fact that environments are manifold. The idea behind an environment analysis is to investigate an aspect of the environment in question and from this to generalize to the environment per se. For example, in the food domain, Rozin and colleagues (2003) focused on package sizes in supermarkets and portion sizes in recipes from classic, bestselling cookbooks. However, as with most research, the question is whether the extracted information is representative, for example it is not clear whether the people who suffer the consequences of these environments are also those who buy the packages of food in the analyzed supermarkets or consult the included recipe books. This kind of limitation also applies to the analyses of diet

books conducted for this dissertation and thus might explain why the analyzed environment structure does not fully reflect empirical results. However, this problem of possibly restricted generalizability inherent in a large number of psychological research does not outweigh the strength of environment analysis: Namely, analyzing the real environment and taking it into account to draw conclusions about behavior, or in Simon's words, considering the beach when investigating the ants' path. The beaches in our study were the bestselling diet books, thus maximizing the possibility that they really are the environment played a role in the dieters' behavior.

A second aspect I want to discuss in the context of the individual cognitive environment of the dieter and its interaction with actual dieting behavior is the finding that complexity of the diet rules used did not predict the length that a woman would stick to her diet. On the one hand, this suggests that we have to learn more about how dieters translate the rules they read about in a diet book into personal guidelines for action. On the other hand, this finding poses exciting new research question about the role that experience plays for perceived cognitive complexity. With time and experience people can become experts in a field, a process also likely to happen with dieters. For example, our participants most likely have translated the information from the diet books into strategies that they simplified over time (with growing experience) so that the rules became easier for them to remember and apply. In the future, it would be fascinating to gain further understanding of this process, for example by following a small group of people who are just about to start a diet and record the information they consult for their weight loss program as well as the rules they use over the course of their diet. In such a study it would be possible to assess the exact diet information environment of the participants as well as the extracted rules and their possible modifications over time.

Contributions to Understanding Food Choice and Future Research

Investigating the influence of the cognitive environment on diet adherence was an important starting point for a better understanding of decision making in the course of a weight loss diet. We investigated decision rules of weight loss diet programs taking the view that complicated food decision rules such as weighting and adding *n* pieces of information (an eating decision process for example suggested by Pudel & Westenhöfer, 1998, p. 259) take up much of a person's cognitive capacity, and that it is more plausible that people use simple rules to make decisions that are good enough (as has been shown by Gigerenzer, Todd, & the ABC Research Group, 1999; Scheibehenne, Miesler, & Todd, in press, for the food domain). We showed that the perceived complexity of diet rules drastically raises the likelihood of giving up a diet prematurely. This finding supports the importance of rules that are perceived as simple for the performance of a health-related behavior in a real-world setting. It is a first promising step toward a better understanding of how the cognitive demands of following rules, such as computations that have to be carried out by the dieter to determine how much she can eat, affect how well and how long a dieter adheres to her diet. To learn more about the actual process of translating (and possibly simplifying, as suggested by Herbert Simon, 1979) rules into behavior, it would be important to study how dieters select relevant information from a diet environment (e.g., a diet book), and form rules; researchers could then test how well these rules are remembered, and how accurately they are applied across different diet environments and with different degrees of diet experience. One promising method to shed light on this process is verbal reports data: Asking people to verbalize their cognitive processes while working on a task or shortly thereafter has been shown to render valuable and reliable information about cognitive processes (Ericsson & Simon, 1980).

Intervention Strategies for Diets and Beyond

Our findings suggest that dieters would greatly profit from simple diet rules or rules that are designed in a way to be perceived as simple (e.g., designing decision aids such as simple trees that facilitate understanding more complex concepts). Dieters have been found to have impaired cognitive functioning, possibly due to preoccupying thoughts about dieting (Shaw & Tiggemann, 2004; Vreugdenburg, Bryan, & Kemps, 2003), and thus might be especially susceptible to the cognitive demands of diet rules. This finding may also apply to other groups with medical conditions. For example, people who have just found out that they have diabetes or kidney disease and consequently need to change and adhere to a new eating behavior long-term might also have preoccupying thoughts related to their diagnosis. They would equally profit from simpler rules of behavior change. Thus, investigating whether our findings apply to other groups would be relevant to designing effective interventions for a larger spectrum of patients.

Food Labels

In the second manuscript, "Meat Label Design: Effects on Stage Progression, Risk Perception, and Product Evaluation," two studies are presented which tested the impact of health-related meat labels on product evaluation and risk perception. The results showed that conjoint assessment of labels can lead to contrary product rankings compared to separate evaluations. Participants seem to have relied on the piece of information that was capable of being evaluated; when a label was presented by itself they used the qualitative attribute and ignored the quantitative characteristic that was not assessable by itself. In conjoint presentation providing a comparison standard for the quantitative information, participants often evaluated this attribute as more important and based their product evaluation on this product characteristic. Moreover, the study results suggest that being exposed to food labels containing specific health-

relevant information can lead to increased risk perception and motivation to consider health aspects in those consumers without previous intention to do so.

Individual or Environment?

In this study we found that food labels can change motivation for a behavior and that environments such as food labels have to be designed such that they can be evaluated by the consumer, thus making product information transparent. One could argue that internal regulation (and labeling of food) is unnecessary if the environment solely provides one version of a product. But as long as there are differences in available products, these differences have to be communicated, for example, through labels. Food labels have to be designed in an understandable way to communicate product differences to the consumer. Thereafter the consumer is more likely to be motivated or able to purchase in accordance with his motives.

Challenges for Future Research

The advantage of studying behavior in the laboratory is better experimental control facilitating the interpretation of the results. However, some question can only be researched in the field: One innovative hypothesis that would be important to study in a field setting is the link between food labels and behavior: From a theoretical perspective (e.g., Schwarzer, 2001) one would not expect a direct link from information to behavior: Information about a behavior and its consequences is thought to merely influence motivation to follow a behavior and not to affect volitional factors specifying the *how* of behavior change. The assumption that specific volitions such as concrete plans are necessary is plausible for changing very complex behaviors, such as physical activity (e.g., as shown by Lippke, Ziegelmann, & Schwarzer, 2004) or eating (Schwarzer et al., 2007). However, the case of food labels could be an exception: While grocery shopping in the supermarket, the consumer reads the information on the food label and—given

the information is relevant to her—becomes motivated to change her behavior. In this case, it is not necessary to make concrete plans about where, when, and how to purchase the product, because the situation already specifies these three aspects for her. The only thing the consumer has to do to change her behavior is to put the labeled product in her shopping cart. Thus, one major advantage of food labels might be that they provide information at the moment of decision (Bettman, Payne, & Staelin, 1987), integrating the *what* and *how* of behavior change. This hypothesis could not be tested in our study unless we had installed a little meat market in our laboratory—thus, it would be promising to conduct such an experiment in a supermarket setting in forthcoming studies.

Contributions to Understanding Food Choice and Designing Future Interventions

Concerning decision making based on food labels, we found that only attributes that can be evaluated, either by themselves or when presented conjointly with a comparison standard, influence the judgment of a product. Further investigating the decision-making process and learning which attributes consumers rely on most in different label designs would not only broaden our understanding of food-related decision making, but could also provide the basis for designing labels that consumers could use to get feedback about their food choices and thereby change their food decisions. Examples of approaches that have already been discussed include a "traffic-light system" (suggested by the Food Standards Agency in 2006, cf. Denny, 2006) that would provide information about foods' nutritional values—for instance, a low-fat food would have a green light for the fat amount; and the carbon footprint, a display of the total amount of CO_2 emitted over the full life cycle of a product (cf. Pollan, 2006); if such a label can be evaluated, the environmental consequences of a food choice would be transparent to the consumer.

Predicting Children's Preferences

The third article, "Predicting Children's Meal Preferences: How Much Do Parents Know?," demonstrates that people are able to make accurate predictions of others' preferences, given their prediction domain is a familiar one. Again, individual factors were contrasted with information from the social environment, this time for evaluating parents' performance. Specifically, the accuracy of predicting the preferences of one's own child was compared with the accuracy of parents' predictions when applied to all other children and to the accuracy of a hypothetical base-rate forecaster, predicting that each child would choose the most popular dish of the day. In general, the two studies showed that parents were better at predicting their own children's preferences.

Parents as Environment

The role of social environment for food choice and intake has received considerable attention, especially from social (e.g., for an overview article see Herman, Roth, & Polivy, 2003) and developmental psychologists (e.g., Birch, 1980 for a review). For prevention of overweight and obesity, it is especially important to consider the parent–child interaction, because parents control the majority of foods their children eat, thus providing their children's eating environment (Birch & Davison, 2001; Birch, Zimmerman, & Hind, 1980). Furthermore, prevention is especially important at a young age—overweight children will most likely be overweight adults (Serdula, Ivery, Coates, Freman, Williamson, & Byers, 1993; Whitaker, Wright, Pepe, Seidel, & Dietz, 1997).

Two interesting questions derive from the understanding of parents as the providers of their children's food environment: First, what factors—be they individual, such as the motivation to provide a healthy diet, or environmental, such as foods advertised on TV or the design of supermarket shelves—shape the kind of food environment parents provide? Second, how do children negotiate their food environment? Do they express wishes for a certain meal, perhaps,

or refuse to eat certain foods? Preference prediction is only one detail of these interactions; observation of real-life situations could complement our findings.

Future Research Contributing to Understanding Food Choice and Possible Interventions

As discussed above, improving prediction accuracy, especially of those parents who are poor predictors of their children's meal preferences, might be an effective intervention to help parents negotiate a larger number of healthier food compromises—this might especially be the case for yet unfamiliar or unknown foods. Ultimately this could foster enlarging the variety of foods that a child eats. To investigate this question further it would be important to take a closer look at the prediction process, especially which cues (from individual food ingredients to television advertisements) parents rely on and how they use these cues to make a prediction. Based on these results it would be possible to derive suggestions for how parents could become accurate predictors by relying on specific cues, widen the variety of foods they expose their children to, and thus hopefully provide a healthier nutrition.

Summary and Conclusions

This dissertation compared individual with environment influences on food-related decision making from a psychological perspective including other adjacent scientific fields. The studies assessed participants of several age ranges and covered different domains of food-related decision making, including weight loss, evaluation of food labels, and preference predictions. The research questions were addressed with a wide array of methods, including a longitudinal online-study, laboratory experiments, and field studies, with a strong emphasis on ecological validity, investigating behavior in its natural context whenever possible.

It has been said that "studying environmental influences on eating behavior is difficult, because environments are difficult to define, measure, and study experimentally" (French et al.,

2001, p. 309). In the course of this dissertation new territory was conquered by defining and measuring information environments, specifically diet books and food labels, and testing their influence on food-related decision making. Although the studies conducted here are only starting points for a better understanding of the processes underlying choice strategies in the food domain, the results are promising and suggest that individuals and their environments are intertwined. This implies that effective interventions will be those that focus on both individual changes, such as motivation to change behavior and plans on how to do so, and environments, for example, adjusting them to meet people's needs. "Gaining a better understanding of such [environmental] influences is critical in order to develop interventions that might reverse the increasing trend in the US population toward overweight" (French et al., 2001, p. 309). These interventions will facilitate changes in food-related decision making and should not be ignored in psychological models of health behavior change.

Although efforts are now being made to change today's obesogenic environment, for example, by removing soda and candy vending machines from schools in the United States, this process will take time and effort, leading people to seek more immediate help in finding strategies for dealing with this modern environment. The findings of the studies conducted in this dissertation contribute to improving people's food choices, can help prevent or at least confine the obesity epidemic that is rampant in the Western world, and supply further knowledge that can fuel possible public health interventions in nutrition and beyond.

References

Bettman, J. R., Payne, J. W., & Staelin, R. (1987). Cognitive considerations in designing effective labels for presenting risk information. In K. Viscusi & W. Magat (Eds.), *Learning about risk: Evidence on the economic responses to risk information* (pp. 1–28). Cambridge, MA: Harvard University Press.

Birch, L. L. (1980). Effects of peer models' food choices and eating behaviors on pre-schoolers' food preferences. *Child Development, 51*, 489–496.

Birch, L. L., & Davison, K. K. (2001). Family environmental factors influencing the developing behavioral controls of food intake and childhood overweight. *Pediatric Clinics of North America, 48,* 893–907.

Birch, L. L., Zimmerman, S. I., & Hind, H. (1980). The influence of social-affective context on the formation of children's food preferences. *Child Development, 51,* 856–861.

Brownell, K. D. (2002). The environment and obesity. In C. G. Fairburn & K. D. Brownell (Eds.), *Eating disorders and obesity: A comprehensive handbook* (2nd ed., pp. 433–438). New York: Guilford Press.

Conner, M., & Armitage, C. J. (2002). The social psychology of food. Buckingham, UK: Open University Press.

Denny, A. (2006). Stop, think, go?—Are signposting labeling schemes the way forward? *Nutrition Bulletin, 31,* 84–87.

Ericsson, K. A., & Simon, H. A. (1980). Verbal reports as data. *Psychological Review, 87,* 215–251.

French, S. A., Story, M., & Jeffery, R. W. (2001). Environmental influences on eating and physical activity. *Annual Review of Public Health, 22,* 309–335.

Gigerenzer, G., Todd, P. M., & the ABC Research Group. (1999). *Simple heuristics that make us smart.* New York: Oxford University Press.

Herman, C. P., Roth, D. A., & Polivy, J. (2003). Effects of the presence of others on food intake: A normative interpretation. *Psychological Bulletin, 129*(6), 873–886.

Hill, J. O., & Peters, J. C. (1998). Environmental contribution to the obesity epidemic. *Science, 280*(5368), 1371–1374.

Kurzenhäuser, S. (2003). Welche Informationen vermitteln deutsche Gesundheitsbroschüren über die Screening-Mammographie? [What information do health brochures about screening mammograms contain?] *Zeitschrift für ärztliche Fortbildung und Qualitätssicherung, 97,* 53–57.

Lippke, S., Ziegelmann, J. P., & Schwarzer, R. (2004). Initiation and maintenance of physical exercise: Stage-specific effects of a planning intervention. *Research in Sports Medicine, 12*, 221-240.

Pollan, M. (2006). *The omnivore's dilemma: A natural history of four meals*. New York: Penguin Press.

Pudel, V., & Westenhöfer, J. (1998). *Ernährungspsychologie. Eine Einführung.* Göttingen: Hogrefe.

Rozin, P., Kabnick, K., Pete, E., Fischler, C., & Shields, C. (2003). The ecology of eating: Smaller portions sizes in France than in the United States help explain the French paradox. *Psychological Science, 14*(5), 450–454.

Scheibehenne, B., Miesler, L., & Todd, P. M. (in press). Fast and frugal food choices: Uncovering individual decision heuristics. *Appetite*.

Schwarzer, R. (2001). Social-cognitive factors in changing health-related behaviors. *Current Directions in Psychological Sciences, 10,* 47–51.

Schwarzer, R., Schüz, B., Ziegelmann, J. P., Lippke, S., Luszczynska, A., & Scholz, U. (2007). Adoption and maintenance of four health behaviors: Theory-guided longitudinal studies on

dental flossing, seat belt use, dietary behavior, and physical activity. *Annals of Behavioral Medicine, 33*(2), 156–166.

Serdula, M. K., Ivery, D., Coates, R. J., Freeman, D. S., Williamson, D. F., & Byers, T. (1993). Do obese children become obese adults? A review of the literature. *Preventive Medicine, 22,* 167–177.

Shaw, J., & Tiggemann, M. (2004). Dieting and working memory: Preoccupying cognition and the role of the articulatory control process. *British Journal of Health Psychology, 9*(2), 175–185.

Simon, H. A. (1979). Rational decision making in business organizations. *The American Economic Review, 69,* 493–513.

Simon, H. A. (1981). The science of the artificial. Cambridge: MIT Press.

Slaytor, E. K., & Ward, J. E. (1998). How risks of breast cancer and benefits of screening are communicated to women: Analysis of 58 pamphlets. *British Medical Journal, 317,* 263–264.

Swinburn, B., & Egger, G. (2004). The runaway weight gain train: Too many accelerators, not enough brakes. *British Medical Journal, 329,* 736–739.

Vreugdenburg, L., Bryan, J., & Kemps. E. (2003). The effect of self-initiated weight-loss dieting on working memory: The role of preoccupying cognitions. *Appetite, 41*, 291–300.

Wansink, B. (2004). Environmental factors that increase the food intake and consumption volume of unknowing consumers. *Annual Review of Nutrition, 24,* 455–479.

Whitaker, R. C., Wright, J. A., Pepe, M. S., Seidel, K. D., & Dietz, W. H. (1997). Predicting obesity in young adulthood from childhood and parental obesity. *New England Journal of Medicine, 337,* 869–873.

Curriculum Vitae

Jutta Mata

Kontakt	Max-Planck-Institut für Bildungsforschung Bereich Adaptives Verhalten und Kognition Lentzeallee 94, 14195 Berlin E-Mail: jmata@mpib-berlin.mpg.de Telefon: +49-30-82406 698
Geburtsdatum und -ort	30.08.1978 in Berlin

WISSENSCHAFTLICHER WERDEGANG

Seit 10/2004	Doktorandin	International Max Planck Research School LIFE, Bereich Adaptives Verhalten und Kognition, Max-Planck-Institut für Bildungsforschung, Berlin
5/ 2007	Gastaufenthalt	Center for Cognitive and Decision Sciences, Universität Basel, Schweiz
01/2007-03/2007	Gastaufenthalt	Department of Psychology, University of Michigan, Ann Arbor, USA
10/2006-12/2006	Gastaufenthalt	Department of Psychology and Cognitive Science, Indiana University, Bloomington, USA
2004	Diplom in Psychologie	Humboldt Universität zu Berlin
2001 - 2004	Hauptstudium Psychologie	Humboldt Universität zu Berlin
2000 - 2001	Hauptstudium Psychologie	Klassische Universität Lissabon, Portugal
1998 - 2000	Grundstudium Psychologie	Georg-August-Universität, Göttingen
1998	Abitur	Edith-Stein-Schule, Darmstadt
1995-1996	Schüleraustausch	Bryan City High School, Bryan, Ohio, USA

STIPENDIEN UND PREISE

2004-2007	Doktorandenstipendium der International Max Planck Research School LIFE
2005	Springer-Preis für die beste Diplomarbeit, Institut für Psychologie, Humboldt Universität zu Berlin
2000-2001	Erasmus-Stipendium zum Studium an der Klassischen Universität Lissabon, Portugal

VERÖFFENTLICHUNGEN

*Mata, J., Scheibehenne, B., & Todd, P. M. (im Druck). Predicting children's meal preferences: What parents do and how they could do better. Appetite.

Gummerum, M., Takezawa, M., Keller, M., & Mata, J. (im Druck). To share or not to share: Moral Negotiations in Economic Decision Making. Child Development.

Mata, J., Scheibehenne, B., & Todd, P. M. (2006). Healthfulness as a cue in school lunch choice? A study with children and their parents. Appetite 47(2), 270.

Scheibehenne, B., Mata, J., & Todd, P. M: (2006). Are parents able to predict the lunch choices of their children? Appetite, 47(2), 275.

Mata, J., & Lippke, S. (2006). Food-label design: Effects on stage movement. Psychology & Health, 21, Supplement 1, p. 98.

Mata, J., Dieckmann, A. & Gigerenzer, G. (2005). Verständliche Risikokommunikation leicht gemacht – Oder: Wie man verwirrende Wahrscheinlichkeitsangaben vermeidet. [Risk communication made easy – or: how to avoid confusing probability statements] Zeitschrift für Allgemeinmedizin, 81(12), 537-43.

EINGEREICHTE MANUSKRIPTE

*Mata, J., Lippke, S., Dieckmann, A., & Todd, P. M. (eingereicht). Meat label design: Effects on stage progression, risk perception, and product evaluation.

MANUSKRIPTE IN VORBEREITUNG

*Mata, J., Todd, P. M., & Lippke, S. (in Vorbereitung). When diets last: Lower complexity increases diet adherence.

Mata, J., Lippke, S., & Ziegelmann, J. (in Vorbereitung). Comparing behavior change towards healthier nutrition in dieters and non-dieters.

Mit * gekennzeichnete Manuskripte sind Teil der Dissertation

EINGELADENE VORTRÄGE

Mata, J., Todd, P.M., Lippke, S. (2007, Mai). Food for thought: How complex eating rules can impede weight loss diet adherence. International Nestlé Research Centre, Lausanne, Schweiz.

Mata, J., Todd, P.M., Lippke, S. (2007, Mai). Food for Thought: How Complex Eating Rules Can Impede Weight Loss Diet Adherence. Center for Decision Sciences, Universität Basel, Schweiz.

Mata, J., Todd, P.M., Lippke, S. (2007, März). The role of cognition in food choice:
How complex eating rules can prevent weight loss diet success. Center for Behavioral and Decision Sciences in Medicine, University of Michigan, Ann Arbor, USA.

Mata, J., Todd, P. M. (2006, Dezember). Food for thought: Adding cognition to the puzzle of eating and overweight. Faculdade de Motricidade Humana, Universidade Tecnica de Lisboa, Lissabon, Portugal.

Mata, J., Scheibehenne, B., & Todd, P. M. (2006, Dezember). School food choice in parents‘ hands: how to be good. Cornell Foods and Brands Lab, Cornell University, Ithaca, New York, USA.

Mata, J. & Todd, P. M. (2006, Dezember). Can cognitive complexity determine compliance? Cornell Foods and Brands Lab, Cornell University, Ithaca, New York, USA.

Mata, J., Scheibehenne, B., & Todd, P.M. (2006, Februar). Predicting the choices of others: Children‘s school lunches. Center for Cognitive and Decision Science, Universität Basel, Schweiz.

Mata, J., Scheibehenne, B., & Todd, P.M. (2006, Februar). Predicting the choices of others: children‘s school lunches. International Nestlé Research Centre, Lausanne, Schweiz.

Wittig (Mata), J., Sacchi, S. & Dieckmann, A. (2005, Februar). How do people process health claims? Center for Cognitive and Decision Science, Universität Basel, Schweiz.

Wittig (Mata), J., Sacchi, S. & Dieckmann, A. (2005, Februar). How do people process health claims? International Nestlé Research Centre, Lausanne, Schweiz.

VORTRÄGE AUF KONFERENZEN

Mata, J., Todd, P. M., & Lippke, S. (2007, August). Deciding weight loss: How complex eating rules prevent diet success. 21. Subjective Probability, Utility and Decision Making Konferenz, Warschau, Polen.

Mata, J., Scheibehenne, B., & Todd, P. M: (2007, Juni). Predicting other’s meal preferences. How well do parents know their children? 6. Treffen der International Society for Behavioral Nutrition and Physical Activity, Oslo, Norwegen.

Mata, J., Todd, P. M., & Lippke, S. (2007, April). Keep it on: How complex diet rules prevent weight loss. British Feeding and Drinking Group, Newcastle, UK.

Mata, J. & Lippke, S. (2006, September). Was ist der Nutzen von zusätzlichen Informationen auf Nahrungsmitteletiketten? 45. Kongress der Deutschen Gesellschaft für Psychologie, Nürnberg.

Mata, J. (2006, Mai). Influence of information structure on food choice. LIFE Spring Academy, Max-Planck-Institut für Bildungsforschung, Berlin.

Mata, J., Scheibehenne, B., & Todd, P. M. (2006, April). Healthiness as a cue in school lunch choice? A study with children and their parents. 30. British Feeding and Drinking Group Meeting und International Conference on Food Choice, Birmingham, UK.

Scheibehenne, B., Mata, J., & Todd, P. M. (2006, April). Are parents able to predict the lunch choices of their children? Paper presented at the 30. British Feeding and Drinking Group Meeting und International Conference on Food Choice, Birmingham, UK.

Mata, J. (2005, Oktober). The role of information for nutrition behavior. LIFE Fall Academy, University of Michigan, Ann Arbor, USA.

Wittig (Mata), J. (2005, Mai). What can cognitive strategies do for health behavior intervention? LIFE Spring Academy, University of Virginia at Charlottesville, USA.

POSTER AUF KONFERENZEN

Mata, J., Todd, P. M., & Lippke, S. (2007, June). Complex diet rules can impede weight loss diet adherence. 6. Treffen der International Society for Behavioral Nutrition and Physical Activity, Oslo, Norwegen.

Mata, J., Scheibehenne, B., & Todd, P. M: (2006, November). Predicting others' preferences: How accurate are parents and what strategies do they use to predict their children's preferences? 27th Annual Conference of the Society for Judgment and Decision Making, Houston, Texas, USA.

Mata, J. & Lippke, S. (2006, August/September). Food-label design: Effects on stage movement. 20th European Health Psychology Conference, Warschau, Polen.

Mata, J. & Lippke, S. (2006, Juli). The design of food labels: The effect on stage movement and risk perception. Meeting of the International Society for Behavioral Nutrition and Physical Activity, Boston, USA.

Mata, J. & Todd, P. M. (2006, Juni). Zu schwierig – zu schwer? Wie Anleitungen zur Verhaltensänderung verständlicher werden können: Eine Untersuchung am Beispiel von Diätanleitungen. II. Interdisziplinärer Kongress Junge Naturwissenschaft und Praxis der Hanns Martin Schleyer-Stiftung und der Heinz Nixdorf Stiftung.

Mata, J., Scheibehenne, B., & Todd, P. M. (2006, Juni). Parents' advice giving on children's lunch choices: How successful can they be? Conference on Advice and Trust in Decision Making, London, UK.

Lippke, S., Schwarzer, R., Ziegelmann, J., Kalusche, A., & Mata, J. (2006, März). Mechanisms of multiple behavior change. Annual Meeting and Scientific Sessions of the Society of Behavioral Medicine 2006, San Francisco, USA.

Wittig (Mata), J. (2005, September). Was können kognitive Entscheidungsstrategien zur Prävention von Übergewicht beitragen? 7. Kongress für Gesundheitspsychologie, Freiburg.

LEHRE

Sommer 2005	Risk Communication (mit Dr. Anja Dieckmann), Charité, Berlin.
Herbst 2007/8	Gesundheitsverhalten von Kindern und Jugendlichen, Universität Vechta.

AD-HOC REVIEWER

British Journal of Social Psychology

WORKSHOPS UND SEMINARE

Mai/ Juni 2006	Advanced Training Workshop in Structural Equation Modeling and Multilevel Modeling in Longitudinal Research; Max-Planck-Institut für Bildungsforschung, Berlin; Lehrende: John J. McArdle & Paolo Ghisletta

Mai-Juli 2006	Online-basierte Datenerhebung und –analyse: Entwicklung, Programmierung und Evaluierung von Onlinestudien, Freie Universität Berlin, Lehrende: Sonia Lippke
Oktober 2005-Februar 2006	Structural Equation Modeling; Freie Universität Berlin, Lehrender: Gabriel Nagy
Februar 2005	Institutional decision making and the law, Max-Planck-Institut zur Erforschung von Gemeinschaftsgütern, Bonn
January 2006	Teaching skills, Max-Planck-Institut für Bildungsforschung, Berlin; Lehrender: Adi Winteler.

BERUFSERFAHRUNG

9/2003-10/2003	Forschungspraktikum	Environment, Behaviour and Society Research Group, University of Sydney, Sydney, Australien.
2002 - 2004	Studentische Hilfskraft	Max-Planck-Institut für Bildungsforschung, Berlin; Bereich für Adaptives Verhalten und Kognition, Berlin.
08/2002 - 10/2002	Praktikum	Technischer Überwachungsverein, Abteilung für Personal und Arbeitsschutz, Berlin.
02/2002 – 04/2002	Praktikum	Psychiatrische Klinik S. José, Lissabon, Portugal